

U.S. DEPARTMENT OF COMMERCE
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PB-288 904

**Computer Assisted Area Source Emissions
(CAASE) Gridding Procedure (Revised).
UNIVAC 1110/EXEC 8 Version User's Manual**

Research Triangle Inst, Research Triangle Park, NC

Prepared for

Environmental Protection Agency, Research Triangle Park, NC

Mar 78

PB 288904

EPA-450/3-78-010

March 1978

**COMPUTER ASSISTED AREA
SOURCE EMISSIONS (CAASE)
GRIDDING PROCEDURE
(REVISED)**

**UNIVAC 1110/EXEC 8
VERSION USER'S MANUAL**

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161



**U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711**

TECHNICAL REPORT DATA (Please read Instructions on the reverse before completing)		
1. REPORT NO. EPA-450/3-78-010	2.	3. RECIPIENT'S ACCESSION NO. 00288904
4. TITLE AND SUBTITLE Computer Assisted Area Source Emissions (CAASE) Gridding Procedure (Revised) UNIVAC 1110/EXEC 8 Version User's Manual		5. REPORT DATE March 1978
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Richard C. Haws, J.W. Dunn, III Richard E. Paddock		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Research Triangle Institute Research Triangle Park, North Carolina 27709		10. PROGRAM ELEMENT NO.
		11. CONTRACT/GRANT NO. 68-02-2501
12. SPONSORING AGENCY NAME AND ADDRESS Environmental Protection Agency Research Triangle Park, North Carolina 27711		13. TYPE OF REPORT AND PERIOD COVERED Final Report - March 1978
		14. SPONSORING AGENCY CODE 200/04
15. SUPPLEMENTARY NOTES		
16. ABSTRACT Atmospheric dispersion modeling programs such as the Climatological Dispersion Model (CDM), Air Quality Display Model (AQDM), and Implementation Planning Program (IPP) are among the most basic tools used for evaluation of air quality and State Implementation Plans (SIP's). Since emissions data comprise the most important input information for these models, any factor affecting the availability and completeness of the emissions data has a significant impact on the results of the modeling programs. Procedures for formatting emissions from point sources are well defined, however area source emission data present problems. Usually the smallest geographic unit for which accurate primary data are available is the county. These data must be disaggregated and appropriately allocated to smaller areas to provide an adequately detailed input. The Computer Assisted Area Source Emissions gridding programs with associated subroutines containing automated gridding procedures provide an objective method for allocating county-level data to grid squares selected on the basis of demographic features and sized to give appropriate detail for input to air quality modeling programs.		
17. KEY WORDS AND DOCUMENT ANALYSIS		
a. DESCRIPTORS Modeling Area Sources Emissions Gridding	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
19. SECURITY CLASS (This Report) Unclassified		21. NO. OF PAGES 483
20. SECURITY CLASS (This page) Unclassified		22. PRICE MF CA21/AD1
18. DISTRIBUTION STATEMENT Release Unlimited		

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by

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Contract No. 68-02-2501

EPA Project Officer: Jerome B. Mersch

Prepared for

**U.S. ENVIRONMENTAL PROTECTION AGENCY
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March 1978

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Publication No. EPA-450/3-78-010

ACKNOWLEDGEMENT

This revision to the manual was prepared by the Research Triangle Institute, Research Triangle Park, North Carolina, for the Environmental Protection Agency under Contract 68-02-2501. The research is under the direction of personnel in the Source Receptor Analysis Branch (SRAB).

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1.0 INTRODUCTION

1.1 General Background

The attainment and maintenance of acceptable air quality within an Air Quality Control Region (AQCR) or an Air Quality Maintenance Area (AQMA) requires the implementation of appropriate strategies to control the emission of pollutants from individual sources or classes of sources. The probable success of candidate control strategies can be evaluated through the use of computer simulation models. These models manipulate source characteristics and meteorological conditions to produce a distribution of ambient air pollutant concentrations over the region being considered.

Simulation models frequently used are based on Gaussian plume formations and accept as input point and/or area sources. Point sources are individually identifiable stacks, process vents, etc., emitting more than some arbitrarily specified mass of pollutant each year. Area sources, however, include the more ubiquitous, individually small sources which cannot be specifically located.

The objective of the Computer Assisted Area Source Emissions (CAASE) gridding method is to improve the characterization of area sources. Basic data for the determination of area source emissions are rarely available for geographic or political units or areas smaller than the county. Such basic data are in the form of annual fuel consumption by fuel type for residential, commercial, institutional, and industrial heating; acreage burned by forest wildfires; landing-takeoff cycles for military, commercial, and civil aircraft; gasoline or diesel fuel consumed by light, heavy, and off-highway vehicles, or vehicle miles traveled by road classification, etc. These data can be converted to pollutant emissions by the application of appropriate emission factors.

The geographic size of a county, however, is too large for practical use in simulation models for AQCR's or AQMA's. Logical procedures are required to distribute the county totals of basic data or derived emissions data to smaller areas. Further constraints imposed by simulation models require that these small areas be squares, although they need not be of uniform size. Various criteria have been proposed for the selection of sizes and the distribution of emission area squares. Urbanization, land use, housing counts, and population have all been used subjectively to grid AQCR's and AQMA's into emission area squares (hereafter called grid squares) and subsequently to allocate county totals of pollutant emissions into each grid square. In general, the philosophy followed has required that urbanized or industrialized portions of a county or study area be gridded into small squares to provide for detailed representation of pollution sources. Conversely, rural areas with few pollution sources are adequately represented by larger grid squares. Essentially, application of this philosophy results in apportioning county total emissions to grid squares according to subjective estimates of the distribution of population. Since air pollution derives from human activity, this procedure provides a reasonable approach to developing area source emission distributions.

The development of the CAASE programs began as an effort to reduce the subjectivity inherent in distributing population into preselected grid squares. Success in this effort would reduce the time and effort required to complete the area source emission distribution.

The Bureau of the Census of the U.S. Department of Commerce has prepared a modified Master Enumeration District List (MEDList) which includes, in addition to the district identification, population count, housing count, etc., the geographic coordinates of the center of area of each of the enumeration districts.

The procedures described in this manual have evolved from a feasibility study (Contract CPA 70-147) in which three AQCR's, 145 (Lancaster, Gage, and Jefferson Counties, Nebraska), 99 (South Central, Kansas), and 130 (Metropolitan Fargo-Moorehead) were gridded. In this study, the ambient air quality indicated by the Air Quality Display Model (AQDM) simulation model, based on a previously prepared (by another EPA contractor) source emissions grid and a corresponding simulation based on the CAASE grid were compared. Because smaller grid squares were used by the CAASE method for central urban areas - where the plotted population data showed concentrations of people - higher peak values of ambient pollutant concentrations were shown for the cities, and sharper gradients of pollutant concentrations appeared in the urban-to-rural transition zone. In rural areas, ambient pollutant concentrations did not differ with the change in the grid system.

Subsequent to the demonstration of feasibility of the CAASE method, 15 AQCR's containing 193 counties were gridded, and area source fuels and emissions were determined for each grid square (Contract 68-02-1014). This resulted in the writing of a User's Manual.* The programs, together with the User's Manual, were then made available by EPA to air pollution control agencies and contractors engaged in dispersion modeling.

In the earlier CAASE method, i.e., before this major revision, a computer drawn plot of the population centers was used in conjunction with the U.S. Geological Survey (USGS) maps to construct a study area grid square system. For each population center, a circle, with its radius proportional to population count, was drawn. Each grid square was assigned to only one county for subsequent emissions apportioning purposes; the user had to take this into

* Computer Assisted Area Source Emissions Gridding Procedure (CAASE) User's Manual, EPA-450/3-74-034, January 1974.

consideration when constructing grid squares near county borders. A description of the resulting grid network was then used by CAASE in subsequent steps. Procedurally, the Universal Transverse Mercator (UTM) coordinates of the lower left hand corner of each grid square, its side length, a sequential identification number, state name, and county name were entered on keypunch load sheets. These data were then keypunched and verified. In subsequent steps, all population and housing counts for an enumeration district (ED) were assigned to the grid square in which the geographic coordinates of the center of the ED were located. This was done because the contained area and configuration of each ED was not available for computer use. Therefore, some grid squares did not have census count data assigned to them and, accordingly, no fuels or emissions were apportioned to these "empty" grid squares. Although the dispersion modeling results using these data were similar to those using data processed by more tedious, subjective, and time-consuming methods, some potential CAASE users were concerned about the "empty" grid squares and were hesitant to use CAASE.

As stated above, each grid square was assigned to only one county. The assignment of apportioning factors by CAASE4 and the allocation of fuels and emissions by CAASE5 was done on a county-by-county basis. The grid squares assigned to a county were the only grid squares used when processing that county. This procedure resulted in some of the population and housing counts not being used after the grid square network had been constructed. The apportioning factor program (CAASE4) read a census enumeration district record and searched the array of grid squares assigned to the county to determine the grid square containing the enumeration district's location coordinates. When the grid square was found, the population and housing counts were added to the sums for that grid square. In some cases, no grid square was found that

contained the enumeration district's coordinates because the grid square containing them had been subjectively assigned to another county. (Population and area were used along with the location of county boundaries when a grid square was assigned to a county.)

Although the apportioning factor program (CAASE4) permitted the user to input subjectively derived weighting factors to modify the objective ones calculated by the program, it still involved a large amount of data preparation time. An entry had to be prepared for each grid-square-source-category combination that the user wanted overridden.

The early CAASE method did not contain a technique for including projected population changes directly.

Since the earlier CAASE method was developed, a computerized data base* has been made available that includes the geographic coordinates of straight line segments approximating the county boundaries for all counties in the contiguous United States. This data base made it possible to objectively determine the location of a grid square in relation to a county. For instance, is it entirely within one county or do county borders transect it, and if it is located on a border or borders, what fraction of its area is located in each county?

The new CAASE methods and algorithms described in this manual incorporate the optional projection of population and housing count data. The new algorithms also include the objective (automatic) computer gridding of the study area including the assignment of population and housing counts to grid squares from each county census in proportion to the area of the grid square

* U.S. Bureau of the Census, DIME County Outline File (DIMECO).

within each county. Since a proximal mapping technique is used (see Section 3), housing and population are assigned to all grid squares in the resulting grid system; i.e., there are no "empty" squares.

In the earlier CAASE method, census data was plotted by CAASE2 to assist in the manual development of the grid square network. The new CAASE2 program uses mathematical techniques to automatically develop the grid square network. The earlier version of the CAASE3 program used a line drawing plotter to draw the grid square network. All line drawing plotter functions have been incorporated within the revised CAASE3 program which is optional. CAASE3 will now optionally plot the census data and the county boundaries in addition to drawing the grid.

1.2 Purpose

Emissions inventory data for all designated primary pollutants are collected for the entire United States. These data are archived by the agencies compiling the inventory and are also sent to the Environmental Protection Agency (EPA) for inclusion in the National Emissions Data System (NEDS). For dispersion modeling, the emissions inventory data must be in a suitable format for the model selected. Atmospheric dispersion models (computer programs) are used for displaying air quality, evaluating state implementation plans (SIPs), and Air Quality Maintenance Area (AQMA) planning and analysis. Key atmospheric dispersion models include the Air Quality Display Model (AQDM), the Implementation Planning Program (IPP), and the Climatological Dispersion Model (CDM).

Point source emissions present few difficulties with regard to formatting the data for use with AQDM, IPP, or CDM. Area source emissions, however, present problems. The smallest geographic unit for which accurate primary data (e.g., annual residential fuel consumption) are available is usually the county. Such data must be disaggregated and appropriately allocated (as

emissions) to smaller areas to provide an adequately detailed input to dispersion models.

The CAASE programs (CAASE1 through CAASE5), with associated subroutines and data bases, provide an objective method for the selection of a set of non-uniform sized grid squares and the subsequent allocation of county-level data.

The automatic gridding features of the revised CAASE method use objective factors of population density, housing density, and political (county) geographic boundaries for selecting a grid-square network.

The revised CAASE method described in this manual provides for the optional manipulation of the Bureau of the Census data for projected changes in population and housing since the last census count (and into the future). The CAASE user can describe a population and/or housing change area by the input of geographic location coordinates of a rectangle (of any size) and growth coefficients, one for population counts and one for housing counts. These coefficients are applied directly to any enumeration district centers that are located within the rectangle. A 0.8 coefficient would indicate a 20% reduction whereas a 1.2 coefficient would indicate a 20% increase. The user can input up to 100 rectangles with associated coordinates and growth coefficients.

The CAASE user can optionally define up to 100 pseudo-enumeration districts* and associated population and housing counts where development is planned or has taken place since the last general census.

*This term is used herein in the context that the user inputs housing and population counts and associated location data (coordinates, state and county identification) for a place that is not the center of a true Bureau of the Census enumeration district. CAASE deals with these pseudo EDs as if they were true EDs.

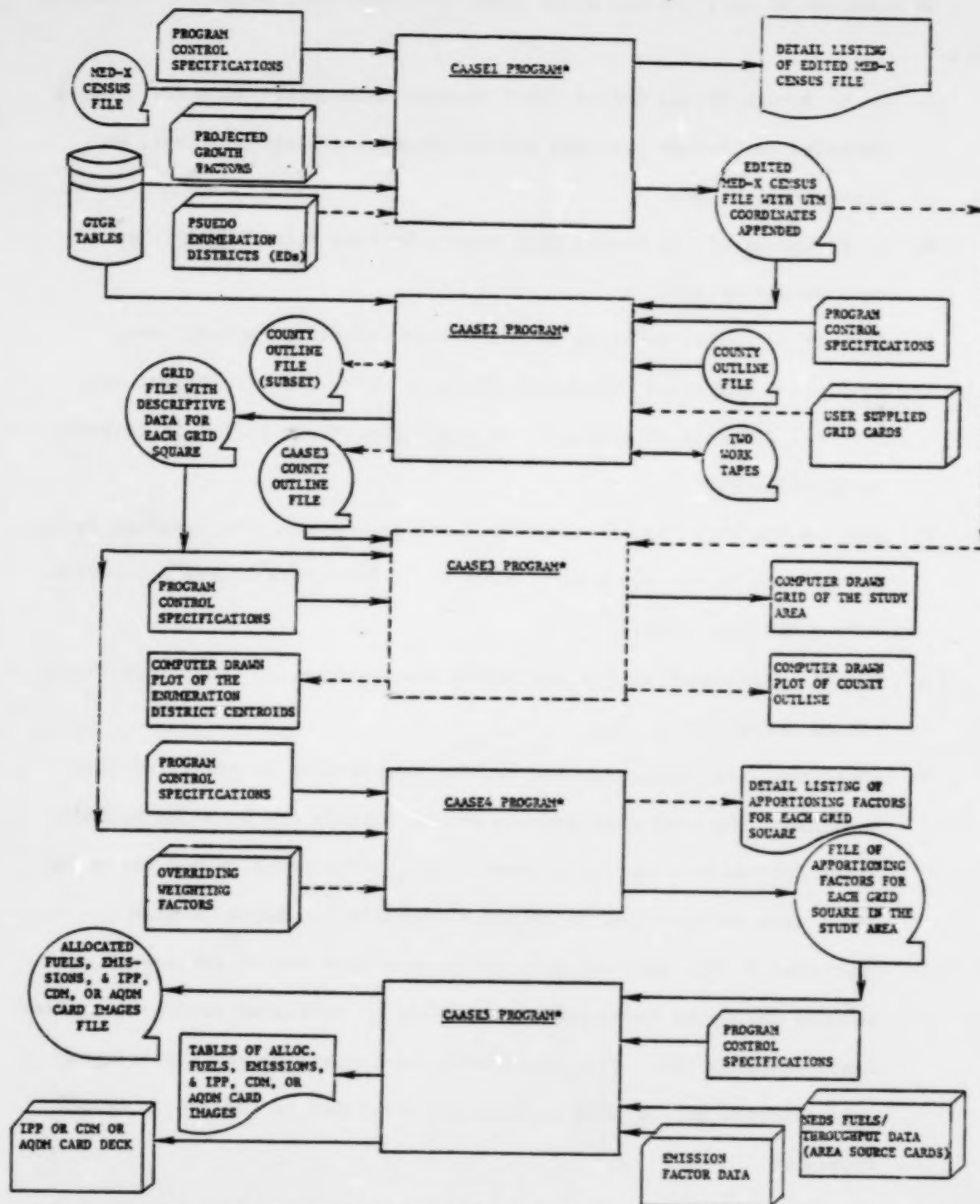
These two census manipulation features, when combined with a projection of fuels used within a county, provide a valuable tool to the user in applying simulation modeling to prepare or evaluate Air Quality Maintenance Plans. Such plans can span from the present time to up to ten (or more) years in the future.

1.3 The CAASE Method

CAASE is a computerized technique for processing county-level primary fuels and emissions data from area source emission categories. CAASE automatically develops a set of non-uniform sized sub-county grid squares for a geographic study area. CAASE then allocates fuels data to the grid squares. CAASE calculates emission totals, by county, and allocates emissions to the grid squares automatically, using either totally objective apportioning factors, or a combination of objective and user-provided overriding weighting factors. CAASE produces tables of allocated fuels, allocated emissions for the five primary pollutants (TSP, SO₂, NO_x, HC, and CO), and atmospheric dispersion model input card images, in a user-selected format, for one of three dispersion models. The tabular output includes data for every grid square, pollutant, and source category combination. Dispersion model input card formats produced by CAASE are formatted for input to the Air Quality Display Model (AQDM), the Implementation Planning Program (IPP), or the Climatological Dispersion Model (CDM).

CAASE consists of five major computer programs including various subroutines called by these programs. For convenience, the programs have been numbered CAASE1 through CAASE5. The programs and their use are discussed in Sections 2 through 6; subroutines are discussed separately in Section 7.

Figure 1 is a flowchart of the overall CAASE system. Sections 2 through 6 contain system flowcharts for each of the major programs. Detailed flowcharts and source language listings for all CAASE programs and subroutines are included in the Appendixes.



*Error messages are output when appropriate; also see output examples for each program.
 ----- Optional

FIGURE 1. FLOWCHART OF THE OVERALL CAASE SYSTEM

In addition to maps for the study area, the CAASE user needs the following data.

- A. U. S. Bureau of the Census MED-X (Master Enumeration District Listing extended to include latitude and longitude coordinates^{*}) tape, as reformatted by EPA.
- B. U. S. Bureau of the Census DIME County Outline File (DIMECO), as reformatted by EPA.
- C. Conversion tables (used by the GTGR subroutine) to convert, when necessary, Universal Transverse Mercator (UTM) location coordinates from one UTM zone to another. (A listing of these tables is included in Appendix F.)
- D. Area Source Data for the counties being processed. The required format is the same as for cards A1 through A5 on NEDS Area Source Input Form [EPA (DUR) 219 3/72].
- E. Current stationary source and mobile source emission factors for area source categories.
- F. (Optional.) If population and housing data are to be projected (i.e., modified), the user must provide growth factors and location coordinates for new housing development areas. (The CAASE method for using these data is described in detail in Section 2, CAASE1 Program.)
- G. (Optional.) The user can optionally read in a set of sub-county grid squares developed independently of CAASE or developed during an earlier CAASE computer run. (The procedures for formatting and inputting a user-supplied set of grid squares are described in Section 3, CAASE2 Program.)

^{*}These coordinates are for the centroid of the enumeration district, the area of the enumeration district is not available on this tape.

H. (Optional.) The user can optionally override any of the sub-county apportioning factors calculated by CAASE. These overriding weighting factors are input on cards. (Section 8 discusses procedures to follow for the assignment of overriding weighting factors; Section 5 details their input formats and their position in the card input stream.)

The following paragraphs present an overview of the functions performed by each of the CAASE programs.

The CAASE1 program processes the census data. State and county selector cards are used to select a subset of the census data for the geographic area being processed.

The user can optionally define areas of population and housing growth. Each growth area is described by the lower left hand coordinates and the side lengths of a rectangle. A growth factor coefficient for housing contained in the rectangle and also a growth factor coefficient for population are provided by the user. Any census enumeration district centroids located within a growth rectangle will have the associated coefficients applied. For example, a housing count coefficient of 1.25 would represent a 25% increase in housing count since the date of the housing count included on the MED-X tape.

The program also permits the user to include pseudo-enumeration districts for more localized growth areas. For CAASE purposes, a pseudo-enumeration district is defined herein as user-provided inputs of housing and population counts and associated location data (coordinates, state and county identification) for a place that is not the center of a true Bureau of the Census enumeration district. A new housing development, for example, could be treated as a pseudo-enumeration district.

CAASE1 flags each enumeration district record as being unmodified, growth factor applied, or a pseudo-enumeration district. These flags are later used by CAASE3 for plotting symbol selection if the data are to be plotted.

CAASE1 also converts the latitude and longitude coordinates of each selected enumeration district (from the MED-X tape) to UTM coordinates. If the study area includes data from more than one UTM zone,* CAASE1 converts the UTM coordinates to the primary zone selected by the user.

CAASE2 is the automatic gridding program. It computes a system of grid squares over a collection of contiguous counties making up the study area. The grid squares are not necessarily of uniform size but are selected such that each grid square contains approximately the same number of people. Population and housing contained in each grid square is given by the integral of the entire population and housing density surfaces that are contained in the grid square.

For those grid squares that contain area from more than one county, the grid square is assigned to each county that contains a portion of the area of the grid square. Each of the grid squares containing area from more than one county are processed so that a unique sequential identification number, contained area, population, housing, and the state and county FIPS numbers are assigned for each of the counties; for example, a grid square containing area from three counties would be output by CAASE2 as three grid squares where the coordinates of the lower left hand corner of the grid squares and their side lengths would be common - all other attributes would have different numerical values.

The CAASE2 program permits the user the option to input a grid square network. These user-supplied grid squares are then assigned population and housing counts from the CAASE2 population and housing density surfaces. These grid squares may have been developed independently of CAASE. A more obvious use of the user-supplied grid option is when several CAASE runs are being made

*Each UTM zone spans six degrees of longitude in the east-west direction.

for an Air Quality Maintenance Area plan spanning several years. If a grid square network had been developed by CAASE2 with "base-year" census data, then there are advantages in using the same grid square network for all years in the study. The CAASE user can project the census data to subsequent years using CAASE1 options, and CAASE2 will assign housing and population counts to a user-provided grid square network. Conversely, if census data is projected using CAASE1 options and a user-supplied grid is not input to CAASE2, the grid square network will probably be redefined based on the projected population and housing density surfaces.

CAASE2 optionally outputs a subset of the county outline file in the same format as the input county outline file for efficiency in future runs. CAASE2 also optionally outputs a subset of the county outline file in a format suitable for line drawing plotting using the CAASE3 program.

The CAASE2 computed grid square network is used directly as input by the CAASE4 apportioning factor assignment program. It is also used by the optional CAASE3 program for plotting a scaled grid square network with a line drawing plotter, e.g., a CALCOMP plotter.

The CAASE3 program produces a scaled off-line plotter display of the grid square network output from CAASE2. It will also optionally draw outlines of the county(ies) and/or plot a symbol at the geographic center of each census enumeration district.

The use of CAASE3 is optional but is highly recommended if the user has plotter facilities available. Plotting scale is user-controlled with 1:250,000 having been used in applications thus far. This scale is convenient for using the CAASE3 generated plot as a direct overlay on USGS maps of the study area.

The CAASE4 program calculates apportioning factors for each area source emissions category for each grid square in the study area. (The factors are

used by CAASE5 which does the apportioning.) The calculated apportioning factors are the same for both the fuels (throughput) and the emissions. For example, housing counts for each grid square are used to calculate the apportioning factor for both distillate oil marketed for use as residential fuel and the emissions produced by its combustion.

CAASE4 uses census based data and grid square size to calculate apportioning factors for each area source emissions category and grid square combination. This is a totally objective technique that the user may optionally modify. CAASE4 will use overriding factors at the user's option. Most of the area source categories can be apportioned effectively by CAASE4 without user intervention. For a few categories, the user will probably have access to data that is not directly available to CAASE, for example, the locations of airports, waterways, and railroads; for these categories, the user can prepare and input overriding factors.

A detailed description of the CAASE4 method for calculating apportioning factors (with or without user assistance) is included in Sections 5 and 8 of this manual. It is important for the CAASE user to fully understand a basic concept in the calculation of apportioning factors. All of the apportioning factors output from CAASE4 are "weighted apportioning factors." Each one is the product of an objective apportioning factor - for example, grid square contained population - and a weighting factor. The weighting factor is 1.0 unless overridden by the user. The CAASE user does not replace the objective apportioning factors when he uses the overriding option; he modifies the 1.0 (default) weighting factor coefficients of the objective apportioning factors.

The CAASE5 program performs the functions of calculating the emissions and allocating fuels and emissions to each grid square and source category combination.

CAASE5 reads area source fuels (throughput) data for each county in the study area in the same format as the first five cards (A1 through A5) from the NEDS Area Source Input Form [EPA (DUR) 219, 3/72].

Current area source emission factors are input by the user. The factors can be the national emissions factors published by EPA or those developed by state or local agencies. Emission factors for highway motor vehicles are input directly; those for stationary sources and off-highway mobile sources are scaled for input. The scaling of the emission factor takes into account the scaling of the fuels data and units conversion. (A detailed discussion of how to provide emission factors to CAASE5 and an example of a complete input set are included in Section 6.)

CAASE5 uses the fuels (throughput) totals and the emission factors to calculate county-total emissions in the same way as the NEDS programs.

The county totals for fuels and emissions are allocated to each grid square and source category combination using the apportioning factors calculated by CAASE4. The apportioning factor file output from the CAASE4 program is used as direct input to CAASE5.

CAASE5 completely processes one county in the study area before proceeding to the next county.

For each county, CAASE5 produces the following output:

- A. Tables of allocated fuels for each grid square and source category combination.
- B. Tables of emission totals for the county for each pollutant and source category combination.
- C. Tables of allocated emissions for each grid square, pollutant, and source category combination.
- D. The county total emissions for each pollutant, i.e., the sum of all area source categories.

- E. An atmospheric dispersion model area source input card for each grid square. The required units, scaling, and format for one of three models (IPP, AQDM, or CDM) is selected by the user with an input variable.
- F. A formatted tape file containing the above output data elements.
(This is not a "print tape"; it is provided as a computer readable data base for those users who may want to process CAASE output in ways other than dispersion modeling. A "print tape" can also be produced easily by breakpointing PRINT\$ to a tape file in the Executive Control Language (ECL) stream.)

The potential CAASE user may decide that CAASE would be helpful for allocating fuels and emissions for most of the source categories, but for one or more of the source categories, CAASE will not provide appropriate allocations. If also, the use of overriding weighting factors will not yield desired results, then there is another way to let CAASE do most of the work. This can be done by manipulating input data to either CAASE4 or CAASE5. In running CAASE4, the user can select a source category to be overridden, initialize all grid squares to zero, and then simply not assign a non-zero value to any of the grid squares for the selected source category. CAASE5 will, therefore, have zero apportioning factors for the source category and will not allocate fuels or calculated emissions. The user can also let CAASE4 routinely calculate apportioning factors for the selected source category. The user can then set the fuels (throughput) total for the selected source category to zero on the NEDS area source input card when CAASE5 is run; the result is that CAASE5 has zero fuels and emissions to allocate for the source category. Any source category fuels and emissions not allocated to grid squares by CAASE could then be allocated manually. For dispersion modeling,

any manually allocated emissions would have to be added to the totals output by CAASE5 on the dispersion model input cards.

2.0 CAASE1 PROGRAM

2.1 Program Description

This program processes the census data. It performs several functions: the selection of a data subfile, the conversion of the geographic coordinates of the center of area of each census enumeration district (ED) from latitude and longitude to the Universal Transverse Mercator (UTM) northing and easting system, the optional application of housing and population growth factors, and the optional introduction of pseudo (new) enumeration districts with projected housing and population counts. In those cases where the study area includes data from two UTM zones, one of the zones is designated "primary" on an input card; the UTM coordinates are then converted when necessary to the primary zone. Subsequent CAASE processing of the census data, therefore, uses coordinates expressed relative to only the primary UTM zone.

A description of input information is included in the next subsection. However, the introduction of census growth factors and/or pseudo-enumeration districts, and the selection of a primary UTM zone for those study areas spanning two UTM zones is critical and requires a detailed discussion.

The concept of applying growth coefficients (increase or decrease) over a general area is quite different from the concept of adding a pseudo-enumeration district. In the case of growth coefficients, a rectangle is defined. Any enumeration district having its center of area located within the rectangle will have the user-supplied coefficients of housing and population growth applied to it. A rectangle of growth is defined to CAASE1 by the UTM coordinates of its lower left hand corner and its side lengths. A growth rectangle can be of any size, representing a subsection of the study area or even spanning the entire study area. It would most probably be used in a case where there was general growth in an area.

Conversely, the concept of a pseudo-enumeration district is associated with a more localized growth area. The input of a pseudo-enumeration district could be used, for example, to include a new residential housing development either constructed since the last general census count or planned to be developed prior to the projected study year.

In the optional introduction of census data modifications, all location coordinates are expressed in kilometers in the UTM system. (Latitude and longitude coordinates will yield erroneous and unpredictable results.) Because the maps being used would have true UTM zone numbers and coordinates, CAASEI is programmed to receive true coordinates and zone numbers as user-furnished input. The conversion of coordinates to the primary zone, when necessary, is performed automatically by the program. In those cases where a rectangle of growth straddles a zone boundary, the user should input the coordinates and zone number of the lower left hand corner of the rectangle and the X and Y side lengths in kilometers. One corner and the side lengths are used because a true rectangle (four right angle corners) would not be developed if all four corners were not expressed relative to the same UTM zone. The UTM northing (Y) axis in one zone is not parallel to one in a neighboring zone.

The user is cautioned that when applying growth coefficients, a coefficient for both population and housing is required. The CAASEI program expects two coefficients for each rectangle of growth. If only the housing count or only the population count is to be modified, the user must input a coefficient of 1.0 for the count that is not to be modified. If the coefficient of growth for a rectangle is left blank for either housing or population, the CAASEI program will interpret the coefficient as being equal to zero and will eliminate the count for enumeration districts located within the rectangle. By using a growth coefficient of zero, CAASEI does facilitate the removal of a housing area, for example, through urban renewal projects.

In the case of adding pseudo-enumeration districts to the MED-X census data, all parameters that are used by the CAASE2 program must be included; an output record similar to an original MED-X input record is written. All parameters needed by CAASE2 appear in the same positions in each record as though they were actual enumeration districts. The record written for each pseudo-enumeration district has blanks for those data fields of no interest to the CAASE method, for example, congressional district codes. For each pseudo-enumeration district, the required information includes: state and county FIPS codes, UTM zone number, X and Y (easting and northing) UTM coordinates of the center of area, housing count, and population count. Because of the order of processing in CAASE1, pseudo-enumeration districts do not have coefficients of growth applied to them even if they are located inside a growth rectangle.

The MED-X census data is used directly as input to CAASE1. The UNIVAC-1110 version of CAASE1 requires a special-format tape created to contain the entire MED-X data on one reel in one file. The internal subroutine READIT in the UNIVAC version of the CAASE1 main program reads the tape into an internal buffer; the main program unblocks it via the Fortran V DECODE instruction. Within the MED-X file, each state is in ascending numerical FIPS code order; within each state the counties are in ascending FIPS code order. Subsequent CAASE programs require that the census enumeration districts be in ascending FIPS state and county code order and must, therefore, be specified in that order in the CAASE1 input stream.

In designating a primary UTM zone for a study area that includes data from two neighboring UTM zones, care must be taken. In selecting the primary UTM zone, the user would normally select the zone containing the highest percentage of included area of the total study area. There is some distortion

introduced in converting location coordinates from one UTM zone to another. This can be minimized by selecting the primary zone causing the least amount of zone-to-zone conversion. These considerations notwithstanding, the user is cautioned that decisions made in using CAASE1 can yield undesirable results in other CAASE programs. For example, in CAASE5, the input cards for the dispersion models are produced. In the case of the Implementation Planning Program (IPP), the "X" location coordinates cannot exceed 999.9 km because of the field width; also, no provision is made for a signed value. The user, therefore, should designate a primary zone that will not cause "pseudo" negative UTM coordinates or easting (X) coordinates greater than 999.9 km in the conversion process.

The program uses the subroutine GTGR (grid-to-grid) for zone-to-zone conversion of coordinates. GTGR uses an 8 by 8 by 61 set of tables for the conversion algorithm. These tables are stored on a Fortran-defined direct access file. These tables and a simple Fortran program for creating a direct access disk file for input to the GTGR subroutine are included in Appendix F.

CAASE1 uses the CED009 subroutine for converting coordinates from geographic latitude and longitude to the UTM easting and northing system.

These subroutines are described in Section 7. Logical flowcharts and source language listings for CAASE1 and its subroutines are included in Appendix A.

Figure 2 is a system flowchart of the CAASE1 program.

2.2 Input Information

A description of the punched card variables input in the runstream appears in Table 1. The card input includes: the name of the study area, the number of states in the study area, the name of each state, the number of selected counties in each of the selected states, the Federal (FIPS) county and state code numbers, and the name of each county. Also included is the primary UTM

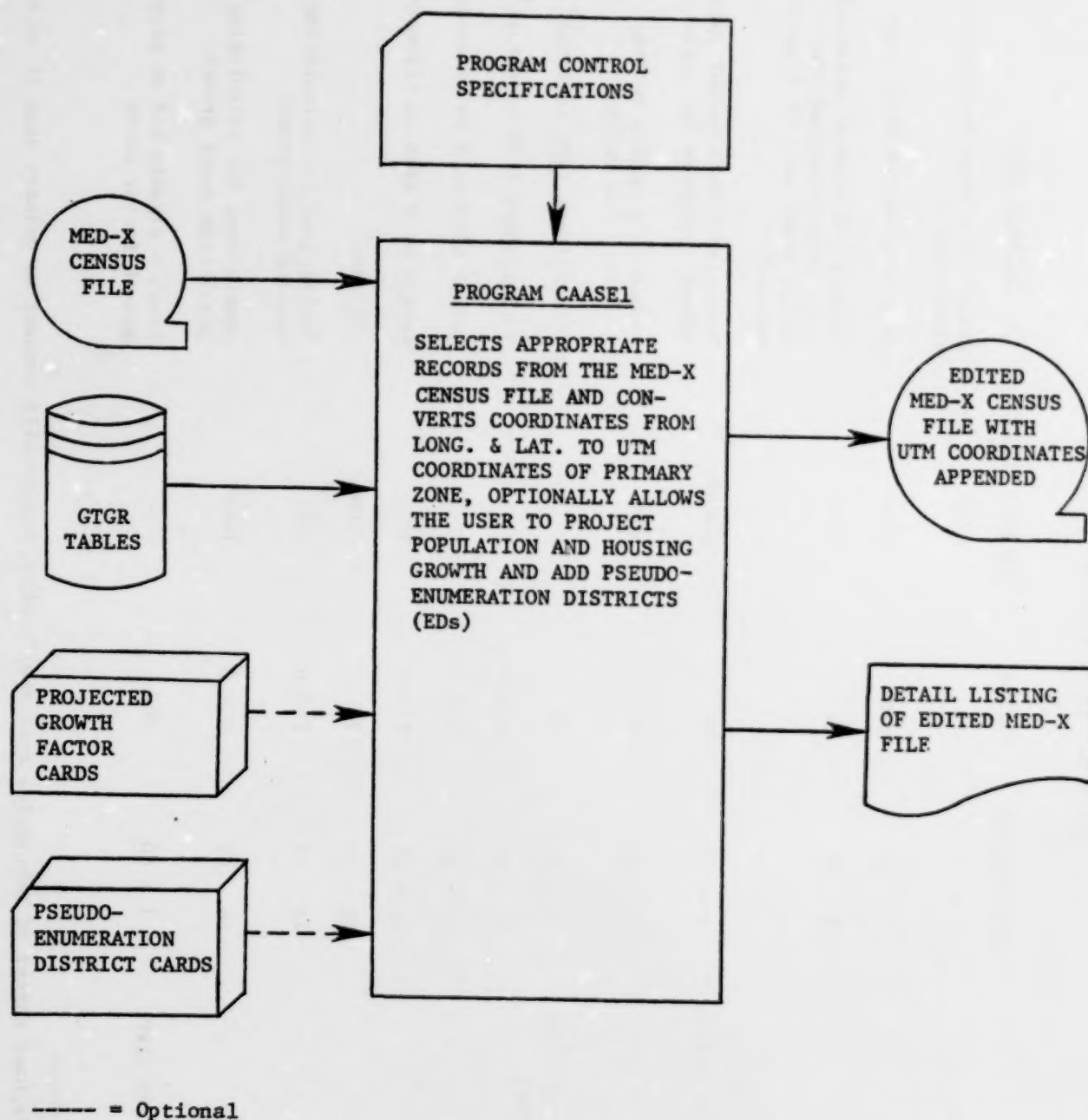


FIGURE 2. SYSTEM FLOWCHART OF CAASE1 PROGRAM

TABLE 1. INPUT CARD LAYOUT, CAASEI

<u>Card Type</u>	<u>Card Columns</u>	<u>Format</u>	<u>Variable Name</u>	<u>Description</u>
STUDY AREA CARD	1 - 4	I4	NSTAT	Number of states in selected study area
	5 - 24	5A4	AQCR	Name of selected study area
	25 - 28	I4	KZONE	Primary UTM zone of selected study area (required even if entire study area is located in one zone)
GROWTH/PSEUDO ED OPTION CARD	1 - 5	I5	IGROTH	Projected growth factor option switch (non-zero for option)
	6 - 10	I5	IEDS	Pseudo ED's option switch (non-zero for option)
PROJECTED GROWTH CARDS (MAXIMUM = 100)	1 - 10	I5	X	X-coordinate (UTM easting)*
	11 - 20	F10.0	Y	Y-coordinate (UTM northing)*
	21 - 30	F10.0	XL	Length of X axis in kilometers
	31 - 40	F10.0	YL	Length of Y axis in kilometers
	41 - 45	I5	JZONE	UTM zone*
	46 - 55	F10.0	HCOEF	Coefficient for calculating housing count growth
	56 - 65	F10.0	PCOEF	Coefficient for calculating population count growth
GROWTH DELIMITER CARD	1 - 80	80X	--	Blank - signals end of projected growth factor cards

*Of lower left hand corner of rectangle, true zone number; CAASEI will convert to primary zone if necessary.

TABLE 1. INPUT CARD LAYOUT, CAASEI (CONTINUED)

<u>Card Type</u>	<u>Card Columns</u>	<u>Format</u>	<u>Variable Name</u>	<u>Description</u>
PSEUDO ED CARDS (MAXIMUM = 100)	1 - 10	F10.0	XX	X coordinate (UTM easting)
	11 - 20	F10.0	YY	Y coordinate (UTM northing)
	21 - 25	I5	KZONE	UTM zone*
	26 - 30	I5	ISTAT	FIPS state code
	31 - 35	I5	KOUNTY	FIPS county code
	36 - 45	F10.0	HCOUNT	Housing count (unscaled)
PSEUDO ED DELIMITER CARD	46 - 55	F10.0	PCOUNT	Population count (unscaled)
	1 - 80	80X	--	Blank - signals end of pseudo ED cards
STATE CARD	1 - 4	I4	NCNTY	Number of counties in selected state (maximum = 30)
	5 - 24	5A4	STATE	Name of selected state
	25 - 28	I4	KSTATE	FIPS state code number of selected state
COUNTY CARDS	1 - 4	I4	ICNTY	FIPS county code number of selected county
	5 - 24	5A4	CNTY	Name of selected county

*True zone number; CAASEI will convert to primary zone if necessary.

zone number and program control variables indicating whether areas (rectangles) of growth and/or pseudo-enumeration districts are to be input.

Figure 3 shows the input order and the deck configuration for the various card types. An ECL example for the runstream appears in Section 2.4

The MED-X census data tape is read directly by CAASE1. The record layout for the MED-X tapes appears in Table 2.

Conversion tables are used for converting UTM coordinates to the primary UTM zone when necessary. These tables must be written to a Fortran-defined direct access file before using the CAASE1 program (see Appendix F). CAASE1 automatically reads the tables when a zone-to-zone conversion is necessary.

2.3 Output Information

Printed output from the program includes the names of the study area, state(s), and county(ies) being processed. Also printed are the input variables describing all rectangles of growth, pseudo-enumeration districts, and the total number of each (optionally input) for the entire study area. When all records for a county of interest have been processed, the county name, its number, and the number of records written on magnetic tape are printed. Figure 4 is an example of printed output from CAASE1. For each county, the first 25 records of the edited MED-X data are printed. These records are not shown in Figure 4. The number 25 was arbitrarily chosen when the CAASE1 source code was written; the user can easily change the number if desired.

A magnetic tape is written where the first records for each county are the optional pseudo-enumeration districts. In addition to the data fields read from the MED-X tape, each record on the output tape (i.e., the edited MED-X data) includes the primary UTM zone number, UTM easting and northing coordinates, and a code number. The code number indicates whether the housing and population

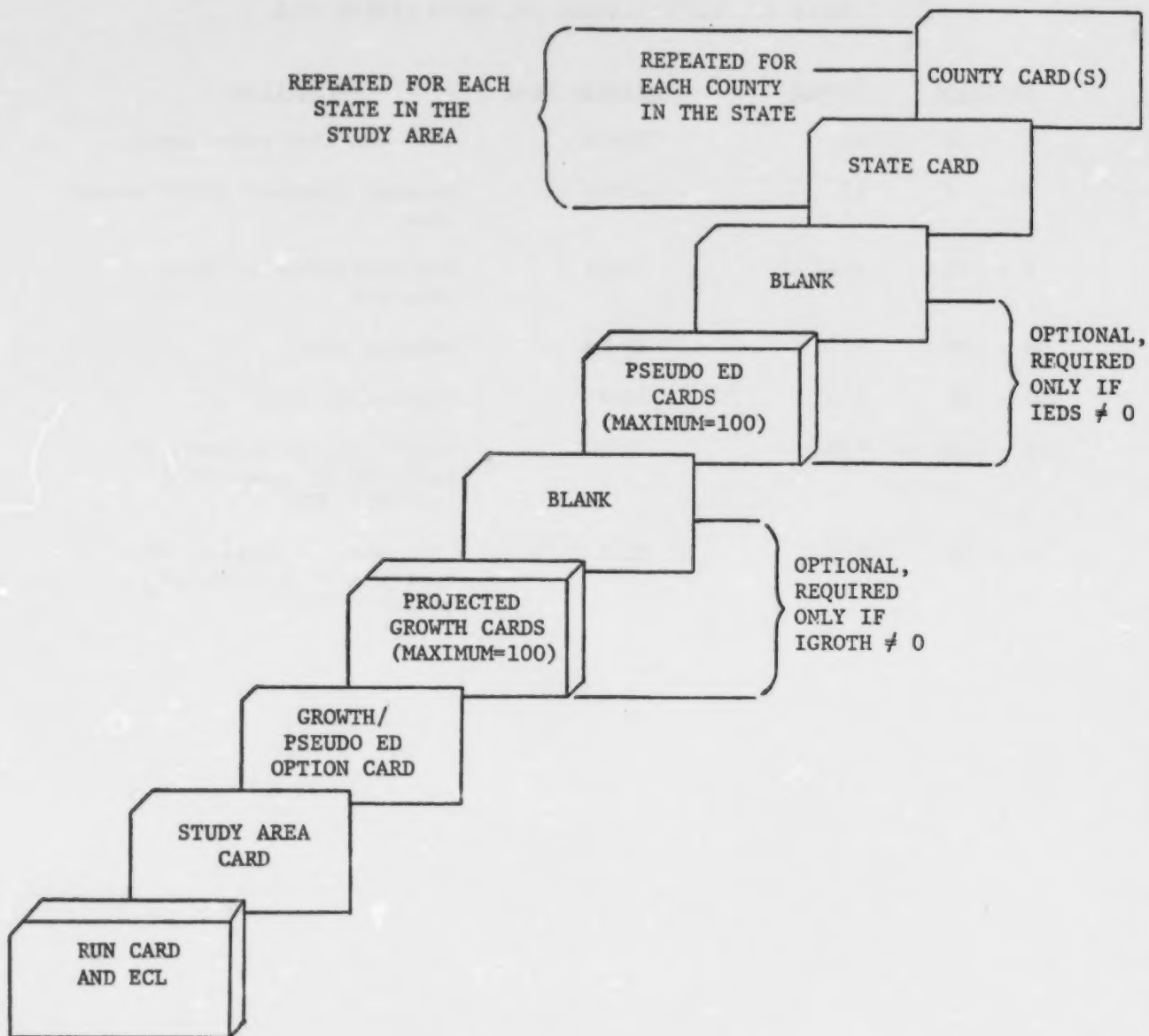


FIGURE 3. INPUT DECK CONFIGURATION FOR CAASE1 PROGRAM

TABLE 2. RECORD LAYOUT FOR MED-X CENSUS FILE

<u>Position</u>	<u>Format</u>	<u>Variable Name</u>	<u>Definition</u>
1 - 4	A4	XDATA	1970 and 1960 state codes
5 - 7	I3	JCNTY	Federal standard (FIPS) county code
8 - 93	21A4,A2	XDATA	Not applicable to CAASE programs
94 - 100	F7.0	XHOUS	Housing count
101 - 108	F8.0	XPOP	Population count
109 - 118	F10.4	XLONG	Longitude, in degrees, of centroid of enumeration district (ED)*
119 - 128	F10.4	XLAT	Latitude, in degrees, of centroid of enumeration district (ED)*

*If longitude and latitude are both zeroes, the record is a summary count for several enumeration districts (CAASE1 therefore skips the record).

CAASE1

STUDY AREA IS PARKERSBURG-MARIETTA

NO. OF STATES INCLUDED IS 2

PRIMARY UTM ZONE IS 17

9ATHENS

105MEIGS

115MORGAN

167WASHINGTON

THE STATE OF OHIO

HAS

4 COUNTY(IES)

THE STATE OF OHIO
COUNTY NAME

CODE NO.

NO. OF RECORDS
WRITTEN ON TAPE

ATHENS

9

55

MEIGS

105

28

MORGAN

115

21

WASHINGTON

167

64

35JACKSON

73PLEASANTS

95TYLER

103WETZEL

107WOOD

THE STATE OF WEST VIRGINIA

HAS

5 COUNTY(IES)

FIGURE 4. EXAMPLE OF PRINTED OUTPUT FROM CAASE1

THE STATE OF WEST VIRGINIA COUNTY NAME	CODE NO.	NO OF RECORDS WRITTEN ON TAPE
JACKSON	35	24
PLEASANTS	73	12
TYLER	95	15
WETZEL	103	28
WOOD	107	131

GOOD FINISH

FIGURE 4. EXAMPLE OF PRINTED OUTPUT FROM CAASE1 (CONT.)

counts have been modified for the enumeration district or if it identifies a pseudo-enumeration district. A record layout for the edited MED-X tape appears in Table 3.

No growth areas or pseudo-enumeration districts were introduced to CAASE1 in the Parkersburg-Marietta AQCR study area used as an example in this manual.

Self-explanatory error messages are printed when appropriate, and, if the error is fatal, the program operation is terminated.

2.4 Executive Control Language (ECL) and Deck Setup

An example of a deck setup configuration is illustrated in Figure 3. Using the Parkersburg-Marietta AQCR (#179) as an example study area, the associated ECL and input data cards are illustrated in Figure 5 and describe the following:

- A. The program is in absolute form in cataloged file "A" on mass storage.
- B. The edited MED-X census data file will be written on tape as Fortran unit number 4. It will be labeled "AQCR179-MEDX". The volume and serial name is "AAAAAA".
- C. The grid-to-grid conversion tables file is cataloged on disk as Fortran unit number 8. It is labeled "GRDTB66".
- D. The MED-X census data are on tape as Fortran unit number 7. It is labeled "SRAB*MEDX". The volume and serial name is "BBBBBB".
- E. The state and county select cards are on the installation dependent standard card input device. The study area includes data from two states and the primary UTM zone is 17. Four Ohio counties and five West Virginia counties are to be selected. No growth area or pseudo-enumeration district cards are to be read.
- F. The printer is the installation dependent standard device number.

TABLE 3. RECORD LAYOUT FOR EDITED MED-X FILE

<u>Position</u>	<u>Format</u>	<u>Variable Name</u>	<u>Definition</u>
1 - 4	A4	XDATA	1970 and 1960 state code
5 - 8	I4	JCNTY	Federal standard (FIPS) county code
9 - 94	21A4,A2	XDATA	Not applicable to CAASE programs
95 - 101	F7.0	XHOUS	Housing count
102 - 109	F8.0	XPOP	Population count
110 - 134	D25.16	XLONG	Longitude, in degrees of centroid of enumeration district (ED)
135 - 159	D25.16	XLAT	Latitude, in degrees of centroid of enumeration district (ED)
160 - 164	I5	KZONE	Primary UTM zone
165 - 179	F15.2	XOUT	UTM coordinate (easting) for this enumeration district
180 - 194	F15.2	YOUT	UTM coordinate (northing) for this enumeration district
195 - 198	I4	KODE	Describes type of record, where: 1 Denotes housing and population counts unchanged 2 Denotes modification of housing and/or population count in record by a growth coefficient 3 Denotes record is a pseudo-enumeration district*

*A pseudo-enumeration district is one optionally provided by the CAASE user to represent housing and population growth since the census year represented by the MED-X input data.

```
@RUN 21RC1P/18/2,acct-code/user-id,project,time
@PASSWD password
@ASG,A A.
@ASG,T/W AQCR179-MEDX.,T,AAAAAA,0
@USE 4.,AQCR179-MEDX.
@ASG,A GRDTB66.,D
@USE 8.,GRDTB66.
@ASG,T SRAB*MEDX.,T,BBBBBB
@USE 7.,SRAB*MEDX.
@XQT A.CAASE1
      2PARKERSBURG-MARIETTA 17
        0 0
        4OHIO
        009ATHENS
        105MEIGS
        115MORGAN
        167WASHINGTON
          5WEST VIRGINIA
        035JACKSON
        073PLEASANTS
        095TYLER
        103WETZEL
        107WOOD
@EOF
@FIN
```

FIGURE 5. ECL AND INPUT DATA CARDS FOR CAASE1

2.5 Warnings and Limitations

For study areas including data from two UTM zones, the importance of selecting the primary zone was discussed above. If the user simply makes an error on assigning the primary UTM zone number, e.g., a keypunch error (or omission), the results will be unpredictable and erroneous.

CAASEI dimensions have been written to accept up to 100 rectangles of growth and up to 100 pseudo-enumeration districts; this should prove adequate, but the user can easily increase the dimensions if necessary.

3.0 CAASE2 PROGRAM

3.1 Program Description

CAASE2 computes a system of grid squares over a user-defined collection of counties (the study area) on the basis of the population contained within the study area. The objective is to produce a grid system such that each grid square contains approximately the same number of people. This means, in application, that regions of high population density are partitioned into a large number of small squares and regions of low population density are partitioned into a small number of large squares. The population contained in any grid square is given by the integral of that portion of the entire population density surface that is contained in the square. The partition is such that the population is approximately the same from square to square.

In developing a grid system by hand, census tract maps showing the populations and outlines of the various census tracts in the study area are used with transparent overlays on which the grid squares are drawn. (This procedure is described in the EPA publication "Guide for Compiling a Comprehensive Emission Inventory," APTD 1135, pp. 7-5 through 7-10.) The population within a given census tract is assumed to be uniformly distributed. The population in the fractional area of a census tract that falls within a grid square is assigned to that grid square; therefore, the final total population of a grid square is the sum of all such fractional contributions from one or more census tracts.

Unfortunately, data for the census tract boundaries do not exist in machine readable (computerized) form. To have an automated gridding system, it is necessary to approximate in some manner the outlines of the census tracts. CAASE2 employs the method of proximal map construction to estimate the previously unknown census tract boundaries. After the approximate

boundaries are established, the previous assumption of uniform population distribution is made and grid squares are constructed on the resulting population density distribution (surface).

Several steps in CAASE2 leading to the construction of the grid square system, deal with (1) the definition of the study area in terms of numerical county outline data, (2) the creation of a proximal map and a population density surface, and (3) the gridding procedure. Ignoring the details of step (1), and, assuming a defined study area of 1 km by 1 km unit cells, the construction of the proximal map and the population density surface takes place as follows. Each unit cell has an assigned value of 1 km² if it is interior to the boundary, 0 km² if it is exterior to the boundary, and a value between 0 and 1 km² if it is on, or transected by, the boundary. Essentially, this is the operative definition of the study area. Also, associated with each cell are the census enumeration districts (ED's) whose centroid coordinates fall within that cell. There may be none, one, or more such ED's for a cell. Unit cells with one or more ED's assigned to them are called control cells analogous to the cartographer's phraseology of control points (data) in topographic map construction. The proximal map is constructed by assigning to each non-control cell the value of the control cell nearest it. A random number decides ties. Thus, for each control cell there is a collection of non-control cells, namely those closer to it than to other control cells. Collectively, these cells approximate the original census tract (at least down to the resolution afforded by 1 km by 1 km grid cells). The cell areas are summed to obtain the total ED area. The ED population divided by this area is the population density, i.e., the population per square kilometer, throughout the collection of cells. Since all the cell sizes are 1 km², the value of population density assigned to each cell is simply the population in that

cell. While the discussion has been limited to population, the same applies to housing and housing density.

The above process is applied to every control cell. Eventually, the entire study area has values of population (and housing) assigned to all unit cells. This set of values is the population density surface.

The gridding procedure attempts to overlay grid squares on the proximal map so that each square contains approximately the same population. (The population of any grid square is simply the sum of the populations of the unit cells in that square.) Somewhere there is at least one unit cell of maximum population, and this unit cell will be the smallest grid square. This maximum value of population is approximately the population which all other squares are to contain in the partitioning. Thus, the grid system with the study area centered within it is initially a set of squares of equal size that are probably "too large." "Too large" a square means that the total population in the square exceeds the maximum population previously mentioned. The square is then partitioned into 4 smaller squares (daughters) by dividing its side length by 2. The daughters are added to the list of squares in the system. The daughters are then tested for being "too large." Any time the "too large" condition occurs, the square is partitioned down to the next smallest size, until the partitioning reaches the unit cell size, if necessary. If the "too large" condition does not occur, inspection passes to the next square in the list. If there are no more squares in the list, the procedure is completed.

The program uses four types of input data: (1) the edited census data file for each county created by CAASE1, (2) a tape file of county boundary coordinates, (3) punched cards specifying the control variables for the counties processed, and (4) the direct access file used also in CAASE1 for converting county boundary coordinates from one UTM zone to another when necessary. Outputs include a subset file of the particular county boundary

coordinates, various diagnostic and error messages as appropriate, and the grid square file consisting of one record (punched card or card image) of information for each grid square.

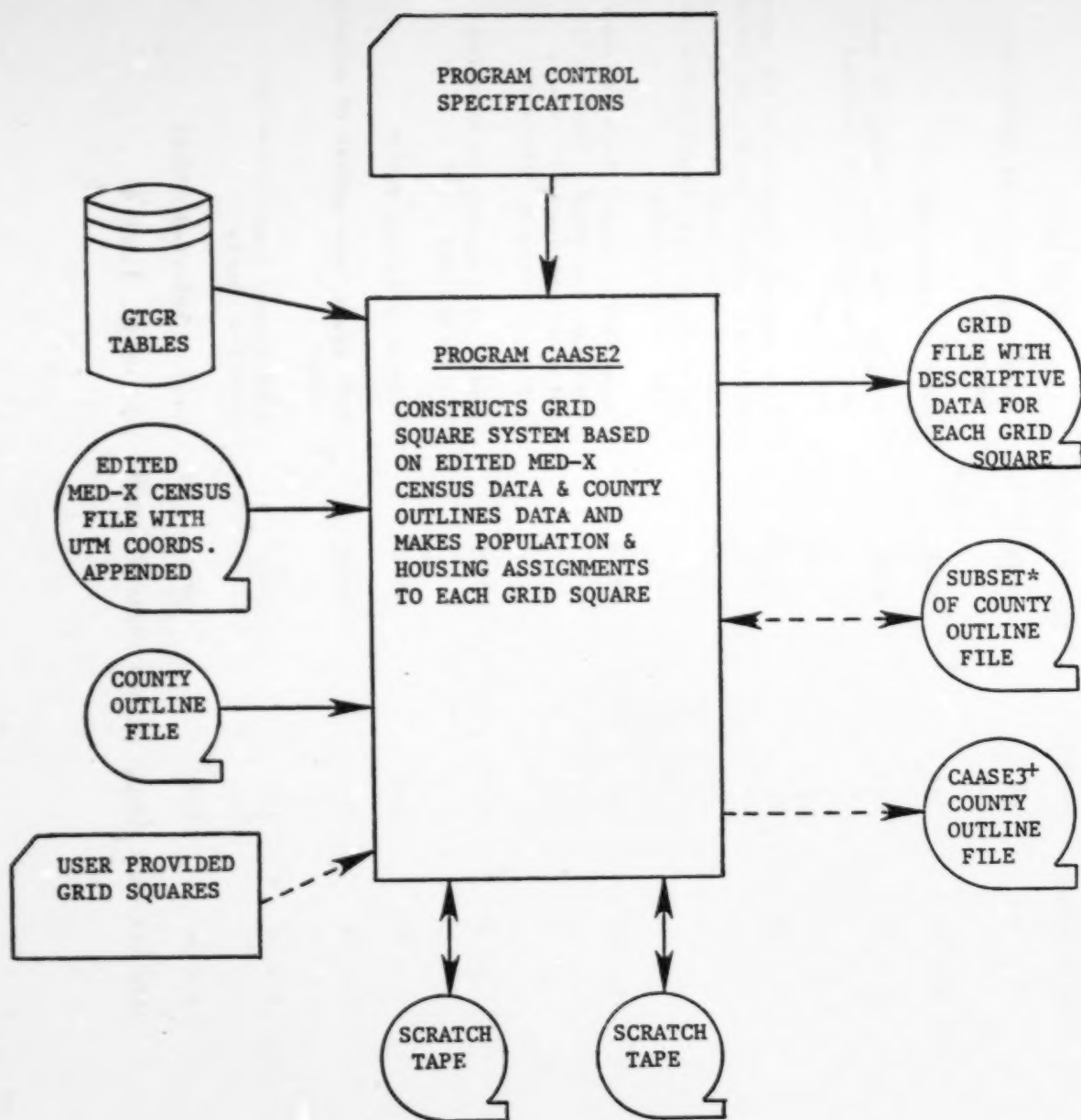
CAASE2 uses several subroutines that are described in Section 7. Logical flowcharts and source language listings for CAASE2 and its subroutines are included in Appendix B.

Figure 6 is a system flowchart for the CAASE2 program.

3.2 Input Information

A description and layout of the punched card input variables in the runstream appears in Table 4. Included are the name of the study area, the number of states in the study area, the name of each state, the number of counties in each state, the FIPS county and state code numbers, the name of each county, and the primary UTM zone. The input deck configuration is shown in Figure 7. The county outline input file is described in Table 5. The output tape of edited census data from CAASE1 is directly used as input to CAASE2. The same direct access file used by the GTGR subroutine in CAASE1 to convert enumeration district coordinates from one UTM zone to another is required in CAASE2 for GTGR conversion of county outline coordinates when necessary.

Punched card input to CAASE2 is identical to the Study Area, State, and County card types for CAASE1 (see Table 4) except for the variables NOUT3 and NPLOT on the Study Area card. A non-zero value for NOUT3 signifies that the user wishes to have the coordinates of the outlines of the counties in the study area written to output device NOUT3. This is appropriate when the user anticipates repeated processing of these outlines and needs to avoid possibly long, time-consuming tape I/O of the total county outline file. A non-zero value for NPLOT signifies that the user wants a county outline file written for input to CAASE3. (NOUT3 and NPLOT are formatted differently.)



----- = Optional

*Can be used to optimize any additional CAASE2 runs for same study area or portions of it.

+Needed only if CAASE3 with county outlines will be run.

FIGURE 6. SYSTEM FLOWCHART OF CAASE2 PROGRAM

TABLE 4. INPUT CARD LAYOUT, CAASE2

<u>Card Type</u>	<u>Card Columns</u>	<u>Format</u>	<u>Variable Name</u>	<u>Definition</u>
STUDY AREA CARD	1 - 4	I4	NSTAT	Number of states in study area (maximum = 10)
	5 - 24	5A4	AQCR	Name of study area
	25 - 28	I4	MTUZ	Primary UTM zone (required even if entire study area is located in one zone)
	29 - 32	I4	NOUT3	Tape device number to write county outlines subset for future CAASE2 runs of same study area. If zero, no writing will occur; hence, no tape is necessary.
STATE CARD	33 - 36	I4	NPLOT	Tape device number to write county outlines for CAASE3 input. If zero, no writing will occur; hence, no tape is necessary.
	1 - 4	I4	NCNTY	Number of counties in selected state (maximum = 15)
	5 - 24	5A4	STATE	Name of selected state
	25 - 28	I4	ICODE	FIPS state code number of selected county
COUNTY CARD	1 - 4	I4	IDCO	FIPS county code number of selected county
	5 - 24	5A4	CNTY	Name of selected county
USER GRID CARDS	[SEE THE GRID SQUARE RECORD FORMAT (COLUMNS 1-45 ONLY), TABLE 6]			

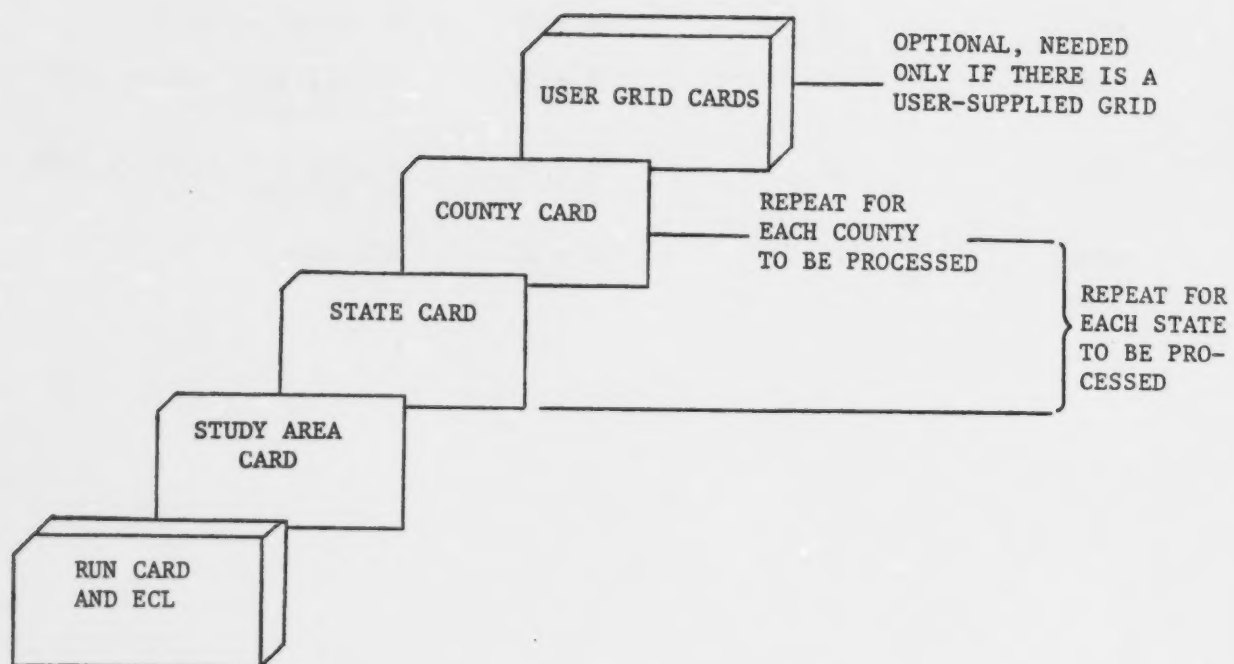


FIGURE 7. INPUT DECK CONFIGURATION FOR CAASE2 PROGRAM

TABLE 5. CAASE2 COUNTY OUTLINE FILE RECORD LAYOUT
(FORTRAN UNITS "NIN1," "NOUT3"*)

<u>Variable</u>	<u>Format</u>	<u>Columns</u>	<u>Comments</u>
ID	I5	1 - 5	State-county code (FIPS)
--	12X	6 - 17	Not used by CAASE
IFE	I5	18 - 22	Starting node easting (UTM coordinates, km)
IFN	I5	23 - 27	Starting node northing (UTM coordinates, km)
--	2X	28 - 29	Not used by CAASE
ITE	I5	30 - 34	Ending node easting (UTM coordinates, km)
ITN	I5	35 - 39	Ending node northing (UTM coordinates, km)
MZONE	I2	40 - 41	UTM zone

*"NOUT3" contains a copy of "NIN1" for the study area counties only. "NOUT3" is created only if the variable NOUT3 is greater than zero on the "Study Area" input card (see Table 4).

If a user-provided grid is to be read in, the cards should be placed in the card input stream immediately following the last of the county cards described in Table 4 of this section. The content and format of the user-provided grid cards are identical* to the format of the punched card (or card image) output records produced by CAASE2 and described in Table 6 of this section.

3.3 Output Information

Printed output from CAASE2 includes the names of the study area (the AQCR name, for example), state(s) and county(ies); counts and/or totals of population, housing, Census Enumeration Districts (ED's), and county outline segments; computed county areas; a printer plotted map of each county showing the boundary and interior region; identification of any ED's whose coordinates place them outside their county of assignment; and a listing of the grid square records that are produced as punched card output or as card image records on other storage devices. Figure 8 is an example of parts of a printed output from CAASE2.

The format of the card image output for the grid square file is given in Table 6. A description of the contained variables appears in Table 7.

Two magnetic work tape output files are required. Two other files are optional. The two required files are necessary as temporary data storage to reduce computer core storage requirements. The first optional file (NOUT3) contains a subset of county outline coordinates that is pertinent to the study area. It is in the same format (see Table 5) as the input file. This option is provided for the user who anticipates running CAASE2 more than once. The second optional file (NPLOT) is created for use by CAASE3, if plotting the

*CAASE2 will assign housing and population counts; the user must provide the remaining data for each grid square.

AIR QUALITY CONTROL REGION IS PARKERSBURG-MARIETTA

NO. OF STATE(S) INCLUDED IS		2	PRIMARY UTM ZONE IS		17
THE STATE OF OHIO					
		HAS	4 COUNTIES IN THE STUDY AREA		39
COUNTY ATHENS		HAS STATE-CNTY CODE (FIPS)	39009		
COUNTY MEIGS		HAS STATE-CNTY CODE (FIPS)	39105		
COUNTY MORGAN		HAS STATE-CNTY CODE (FIPS)	39115		
COUNTY WASHINGTON		HAS STATE-CNTY CODE (FIPS)	39167		
THE STATE OF WEST VIRGINIA					
		HAS	5 COUNTIES IN THE STUDY AREA		54
COUNTY JACKSON		HAS STATE-CNTY CODE (FIPS)	54035		
COUNTY PLEASANTS		HAS STATE-CNTY CODE (FIPS)	54073		
COUNTY TYLER		HAS STATE-CNTY CODE (FIPS)	54095		
COUNTY WETZEL		HAS STATE-CNTY CODE (FIPS)	54103		
COUNTY WOOD		HAS STATE-CNTY CODE (FIPS)	54107		
39009	388.5	4338.0	437.4	4380.3	
	399.6	4370.8	390.7	4371.6	
	390.7	4371.6	389.6	4361.4	
	389.6	4361.4	388.5	4351.3	
	388.5	4351.3	391.4	4350.6	
	391.4	4350.6	390.3	4341.0	
	390.3	4341.0	435.3	4338.0	
	435.3	4338.0	436.8	4341.8	
	436.8	4341.8	437.4	4348.8	
	437.4	4348.8	430.5	4349.5	
	430.5	4349.5	430.0	4352.7	
	430.0	4352.7	428.5		
	428.5	4352.7			(ETC.)

FIGURE 8. EXAMPLE OF PRINTED OUTPUT FROM CAAASE2

STATECODE / COUNTY CODE / COUNTY NAME
4 39 167 WASHINGTON

AQCR POPULATION DATA, PARKERSBURG-MARIETTA

TOTAL # RECORDS READ: 169
NUMBER OF RECORDS FOR THIS COUNTY: 64
SUBROUTINE PROXIMAL, CELL # 1, I, J COORDINATES 93 79, IS OUTSIDE THE BOUNDARY OF THIS COUNTY.
ITS POPULATION AND HOUSING COUNTS ARE: 1225. 447.
SUBROUTINE PROXIMAL, CELL # 5, I, J COORDINATES 94 79, IS OUTSIDE THE BOUNDARY OF THIS COUNTY.
ITS POPULATION AND HOUSING COUNTS ARE: 990. 357.

(Example of grid square printout.)

```
373.4255. 565.4415. 17
1 58132 39 9 17 389.000004335.00000 16 0.15976E 04 0.42842E 04
2 71958 39 9 17 405.000004335.00000 16 0.10835E 04 0.29485E 04
3 72368 39 9 17 421.000004335.00000 16 0.94466E 03 0.29529E 04
4 1469 39 9 17 437.000004343.00000 8 0.11773E 02 0.37331E 02
5 7095 39 9 17 385.000004351.00000 4 0.17940E 02 0.49096E 02
6 99076 39 9 17 389.000004351.00000 8 0.65411E 03 0.18590E 04
710000 39 9 17 397.000004351.00000 4 0.75746E 03 0.20306E 04
810000 39 9 17 401.000004351.00000 2 0.20334E 03 0.51805E 03
910000 39 9 17 403.000004351.00000 1 0.10471E 02 0.24824E 02
1010000 39 9 17 404.000004351.00000 1 0.18818E 02 0.53500E 02
1110000 39 9 17 405.000004351.00000 4 0.12478E 04 0.49495E 04
1210000 39 9 17 409.000004351.00000 4 0.98451E 02 0.24861E 03
1310000 39 9 17 413.000004351.00000 8 0.24993E 03 0.67291E 03
14 42463 39 9 17 421.000004351.00000 16 0.31156E 03 0.86567E 03
1510000 39 9 17 403.000004352.00000 1 0.49400E 03 0.50680E 04
```

(ETC.)

SUBROUTINE GRIDIT, FMAX = 0.50680E 04

FINISH CAASE2

FIGURE 8. EXAMPLE OF PRINTED OUTPUT FROM CAASE2 (CONT.)

TABLE 6. FORMAT OF CARD IMAGE RECORDS OUTPUT FROM CAASE2

<u>Record Type</u>	<u>Columns</u>	<u>Format</u>	<u>Variable Name</u>
SUMMARY RECORD	1 - 5	F5.0	XORIG
	6 - 10	F5.0	YORIG
	11 - 15	F5.0	XEND
	16 - 20	F5.0	YEND
	21 - 25	I5	MTUZ
GRID SQUARE RECORD	1 - 5	I5	MM
	6 - 11	I6	IFRAC
	12 - 14	I3	ISTATE
	15 - 19	I5	ICOUNT
	20 - 22	I3	MTUZ
	23 - 32	F10.5	XX
	33 - 42	F10.5	YY
	43 - 45	I3	SL
	46 - 58	E13.5	HOUSIN
	59 - 71	E13.5	POPULA

NOTES:

The Summary Record occurs once as the first card in the file and serves as input to plotting routines in CAASE3.

The Grid Square Record occurs once for each of the grid squares that has been constructed.

See definitions of variables in Table 7.

TABLE 7. DEFINITIONS FOR VARIABLES OUTPUT FROM CAASE2 AS CARD IMAGES

<u>Variable Name</u>	<u>Definition</u>
XORIG	UTM Easting coordinate of the origin of the study area
YORIG	UTM Northing coordinate of the origin of the study area
XEND	The UTM Easting coordinate of the terminus of the study area
YEND	The UTM Northing coordinate of the terminus of the study area
MTUZ	The primary UTM zone of the study area as specified in CAASE1 by the user
MM	MM = 1,2,..., number of grid squares; the grid square number
IFRAC	Fractional area $\times 10^6$ of the grid square that is in county ICOUNT
ISTATE	FIPS number of state containing this grid square
ICOUNT	FIPS number of the county in state ISTATE containing this grid square
MTUZ	The primary UTM zone assigned to the study area
XX	UTM Easting coordinate of the southwest corner of the grid square
YY	UTM Northing coordinate of the southwest corner of the grid square
SL	Side length in kilometers of the grid square
HOUSIN	The housing from county ICOUNT that has been assigned to this grid square
POPULA	The population from county ICOUNT that has been assigned to this grid square

county boundaries by CAASE3 is desired. The layout and format of the optional subset county outline output file (NPLOT) for CAASE3 is given in Table 8.

3.4 Executive Control Language (ECL) and Deck Setup

An example of a deck setup configuration is illustrated in Figure 7. Using the Parkersburg-Marietta AQCR (#179) as an example study area, the associated ECL and input data cards are illustrated in Figure 9 and describe the following:

- A. The program is in absolute form in cataloged file "A" on mass storage.
- B. The edited MED-X census data file (output from CAASE1) is on tape as Fortran unit number 7. It is labeled "AQCR179-MEDX". The volume and serial name is "AAAAAA".
- C. The grid-to-grid conversion tables file is cataloged on disk as Fortran unit number 8. It is labeled "GRDTB66".
- D. The county outline data file is on tape as Fortran unit number 10. It is labeled "COOUT". The volume and serial name is "CCCCCC".
- E. A scratch (or work) tape is on Fortran unit number 9. The volume and serial name is "DDDDDD".
- F. A second scratch (or work) tape is on Fortran unit number 11. The volume and serial name is "EEEEEE".
- G. The grid squares file will be written on tape as Fortran unit number 20. It will be labeled "AQCR179-GRID". The volume and serial name is "FFFFFF".
- H. A subset of the county outline file for the study area (for any further CAASE2 runs) will be written on tape as Fortran unit number 15. It will be labeled "AQCR179-CNTY". The volume and serial name is "GGGGGG".

TABLE 8. RECORD LAYOUT FOR CAASE2 OPTIONAL COUNTY OUTLINES OUTPUT FILE*
(FOR INPUT TO CAASE3)

RECORD TYPE 1: COUNTY HEADER RECORD

<u>Variable</u>	<u>Format</u>	<u>Columns</u>	<u>Comments</u>
IDPREV	I10	1 - 10	County ID (in this card type <u>only</u>) identifies this as header record
XL, YL	F10.1, F10.1	11 - 20, 21 - 30	"Lower left-hand corner" of county (easting, northing)
XH, YH	F10.1, F10.1	31 - 40, 41 - 50	"Upper right-hand corner" of county (easting, northing)

RECORD TYPE 2: BOUNDARY LINE SEGMENT RECORD

<u>Variable</u>	<u>Format</u>	<u>Columns</u>	<u>Comments</u>
	10X	1 - 10	
SMX(1,I) ⁺ , SMX(2,I)	F10.1, F10.1	11 - 20, 21 - 30	Start of line segment (easting, northing)
SMX(3,I), SMX(4,I)	F10.1, F10.1	31 - 40, 41 - 50	End of line segment (easting, northing)

*Output when the input variable "NPLOT" is greater than zero. Used by CAASE3 to plot county outlines on study area plot.

⁺I=ISTART, IEND for number of line segments for the county outline.

```

@RUN 21RC2P/96/7,acct-code/user-id,project,time
@PASSWD password
@ASG,A A.
@ASG,T AQCR179-MEDX.,T,AAAAAA
@USE 7.,AQCR179-MEDX.
@ASG,A GRDTB66,D
@USE 8.,GRDTB66.
@ASG,T COOUT.,T,CCCCCC
@USE 10.,COOUT.
@ASG,T/W 9.,T,DDDDDD
@ASG,T/W 11.,T,EEEEEE
@ASG,T/W AQCR179-GRID.,T,FFFFFF,0
@USE 20.,AQCR179-GRID.
@ASG,T/W AQCR179-CNTY.,T,GGGGGG,0
@USE 15.,AQCR179-CNTY.
@ASG,T/W AQCR179-PLOT.,T,HHHHHH,0
@USE 18.,AQCR179-PLOT.
@XQT A.CAASE2
    2PARKERSBURG-MARIETTA 17 15 18
    4OHIO 39
    9ATHENS
    105MEIGS
    115MORGAN
    167WASHINGTON
    5WEST VIRGINIA 54
    35JACKSON
    73PLEASANTS
    95TYLER
    103WETZEL
    107WOOD
@EOF
@FIN

```

FIGURE 9. ECL AND INPUT DATA CARDS FOR CAASE2

- I. A subset of the county outline file for the study area (for CAASE3 plotting) will be written on tape as Fortran unit number 18. It will be labeled "AQCR179-PLOT". The volume and serial name is "HHHHHHH".
- J. The state and county selector cards are on the installation dependent standard card input device. The study area includes data for two states, and the primary UTM zone is 17. Four Ohio counties and five West Virginia counties are to be selected. Two subsets of the county outline file are requested, one for further CAASE2 processing (unit = 15) and the other for CAASE3 plotting (unit = 18).
- K. The printer is the installation dependent standard device number.

3.5 Warnings and Limitations

Many of the considerations involved in executing CAASE2 are the same as those previously described for CAASE1. CAASE2 relies on careful consideration of the inputs to CAASE1 for a properly edited census data file. There are additional considerations for CAASE2 which pertain mainly to Fortran DIMENSION limitations; those will be discussed later in this section. The modified DIME county outline file has not yet been completely subjected to application and may have data errors for some counties on the file that have not been accessed during the development and testing of CAASE2.

To simplify the card input and enhance compatibility with CAASE1, many variables are set in the main calling program instead of being read in. They are grouped together in the source listing for ease in identification and may be changed as circumstances warrant. A list of these variables appears in Table 9.

The extreme points (farthest north, farthest east, etc.) of the study area are determined by the county outlines. CAASE2 computes a rectangle that will contain the extreme points. The side lengths of the rectangle are the

TABLE 9. VARIABLES DEFINED IN CAASE2 MAIN CALLING PROGRAM

<u>Variable</u>	<u>Default Value*</u>	<u>Definition</u>
NR	5	The card reader device number
NP	6	The printer device number
NPUNCH	1	Device number for output of card images containing header and grid square variables (see Tables 6 and 7)
NIN1	10	Device number for county outline file
NIN2	7	Device number for the edited census data file from CAASE1
NOUT1	9	Device number for temporary data storage device 1; contains population and housing data maps
NOUT2	11	Device number for temporary data storage device 2; contains area data maps
LTWO	32	The maximum permissible grid square side length, where the units are irrelevant but kilometers are assumed; however, the length must be some power of 2, i.e., 2^n
DIMENY	256	A dimension value; it must be $\leq$ the minimum integer multiple of LTWO, i.e., $>$ the north-south extent of the study area.
DIMENX	256	Same as DIMENY but for the east-west extent of the study area
UNITAR	1.	Value of the basic unit area and the minimum size grid square, 1 Km
ISHIFT	2^{18}	A numeric shift multiplier for packing 2 numeric values in a single word where one value occupies bit positions 18 on up to word size
EPS	.00001	If $ a-b < \text{EPS}$, $a=b$
MAXSQR	1800	The maximum permissible number of grid squares
MAXTRY	3	Inability to partition the study area into 1800 or fewer grid squares results in redefining the partitioning criteria and making another attempt - 3 times

*The user may wish to change the values to suit his own circumstances by changing the appropriate statements in the FORTRAN source code.

integer multiples of LTWO (see Table 9) that will just cover the study area centered in the rectangle. The southwest corner of the rectangle becomes the origin of the study area, and its coordinates are integers. The side lengths of the rectangle must not exceed DIMENY in the north-south direction or DIMENX in the east-west direction. It is advisable to actually measure the maximum extents of the study area before running CAASE2 to ensure that the array dimensions DIMENY and DIMENX are sufficiently large. The default value of 256 (km) should be sufficient for most applications. Smaller dimensions may be used and would result in more efficient computer utilization.

A major step in the program is to track the county outlines through the grid array of unit cells. This step, applied to each county, determines which cells within the total grid cell array are peculiar to that county, i.e., which cells are on the boundary, which cells are exterior, and which are interior to the county. Errors, if any, in the county outline data may produce unpredictable results; therefore, it is advisable to compare the computer printer version of the county map with an actual map. If errors exist, the user will have to make the necessary corrections to the county outline data.

The outline tracking procedure solves the equations for determining the intersection of two lines. In this procedure, the variable EPS (see Table 9) is used as zero when testing for equality.

Having established the unit cells belonging to a specific county, the program checks the census data to ensure that the ED census coordinates will fall within either a boundary cell or an interior cell. If the ED coordinates fall in an exterior cell,* a message is printed and the program continues.

*This condition occasionally occurs because of data errors or the differences in the degree of resolution in the MED-X coordinates as compared to the county outline line segments.

The population and housing of the ED are retained in the totals for the county, but the ED itself is no longer used (as a control cell) by the program.

The limitation of 1800 grid squares has placed a somewhat arbitrary limit on other variables which, for economy of computer core memory, share the same common storage as the grid square variables. These variables are the population and housing counts, the coordinates and area of the control cells, that is, those cells in the total grid cell array that contain population. There are five vectors used to store these variables. They are dimensioned 2520 each so that their total storage of 12,600 words equals the storage for the 7 grid square variables. One cannot predict in advance the number of control cells there will be in a particular study area; it is necessary to run CAASE2 to determine this. As previously mentioned, CAASE2 will restart if the number of grid squares being created exceeds 1800. However, if the 2520 storage limit on control cells is exceeded, a message is printed and the program stops. It would then be necessary to increase the dimensions of those variables which are in the COMMON block named SPEC.

The CAASE programs are written in Fortran V. Because CAASE2 has large core storage requirements, even with the use of auxiliary mass (or tape) storage, it is necessary to utilize the extended memory feature for COMMON block SPEC. This is accomplished with the following provisions:

- A. All routines containing COMMON block SPEC must have the COMPILER directive "(XM=3)" as their first statement.
- B. Collection must be accomplished with option "E" for extended memory.
- C. Each of the subprograms must be INCLUDED explicitly, first in the collector input stream, then MAIN, followed by each of the common blocks (block SPEC last), and finally ENTRY FORMAIN\$.

D. Appropriate core storage must be requested on the RUN card. For
DIMENY=DIMENX=256, 94K words are required.

Grid squares that are transected by the outermost boundary of the study area may have an excessive amount of their area exterior to the study area. Such squares are partitioned if the interior area is less than 50 percent of the square's area. There is a minimum side length below which grid squares are not tested for contained area; this value has been set in ENTRY ADJUST, in subroutine GRIDIT, as 4*UNITAR.

If the user supplies a set of grid squares and any square(s) contain area for more than one county, only one description of the square should be input. For those grid squares containing area from more than one county, it is immaterial which county's square is used. In the CAASE2 processing, the selection of a grid square network for the entire study area will be bypassed. However, in later processing by CAASE2, the "shared area" test is made in subroutine SQROFF and a grid square is produced for each county sharing the grid square's area. Therefore, if the grid square network was produced by an earlier CAASE2 run, the user must remove grid squares that have duplicate location coordinates but different county assignments. Failure to do so will result in having redundant grid squares output.

4.0 CAASE3 PROGRAM

4.1 Program Description

The CAASE3 program is optional, but its use is recommended if plotting facilities are available. When used, it provides the user with an off-line plotter display of area source grid squares as defined by CAASE2. In addition, the user may optionally specify that CAASE3 plots county boundaries and/or enumeration districts for the study area. All input data except control card information is produced by either CAASE1 or CAASE2. Control card information specifies the desired scale, whether the user desires enumeration districts and/or county outlines to appear on the plot, and the name (label) the user wishes to appear on the plot.

CAASE3 reads the control cards from the input stream. The minimum and maximum study area information is read from the grid square file output from CAASE2. Scaling is computed, and an error message followed by a run abort occurs if the 29" (assumed) paper width would be exceeded. The output of grid squares from CAASE2 is read, and a run abort occurs if the maximum number of grid squares is exceeded.

Subroutines are called by CAASE3 to actually drive the plotter. POPBOX, EDPLOT, and COOUT subroutines plot the grid, enumeration districts and county outlines, respectively. They are described in Sections 7.27 through 7.29.

The standard plotting scale is 1:250,000; this usually requires wide (29") plotting paper for a significant study area. The user must arrange for appropriate plotter paper through whatever procedures are appropriate at the installation.

Logical flowcharts and source language listings for CAASE3 and its subroutines are included in Appendix C.

Figure 10 is a system flowchart of the CAASE3 program.

(USE IS OPTIONAL)

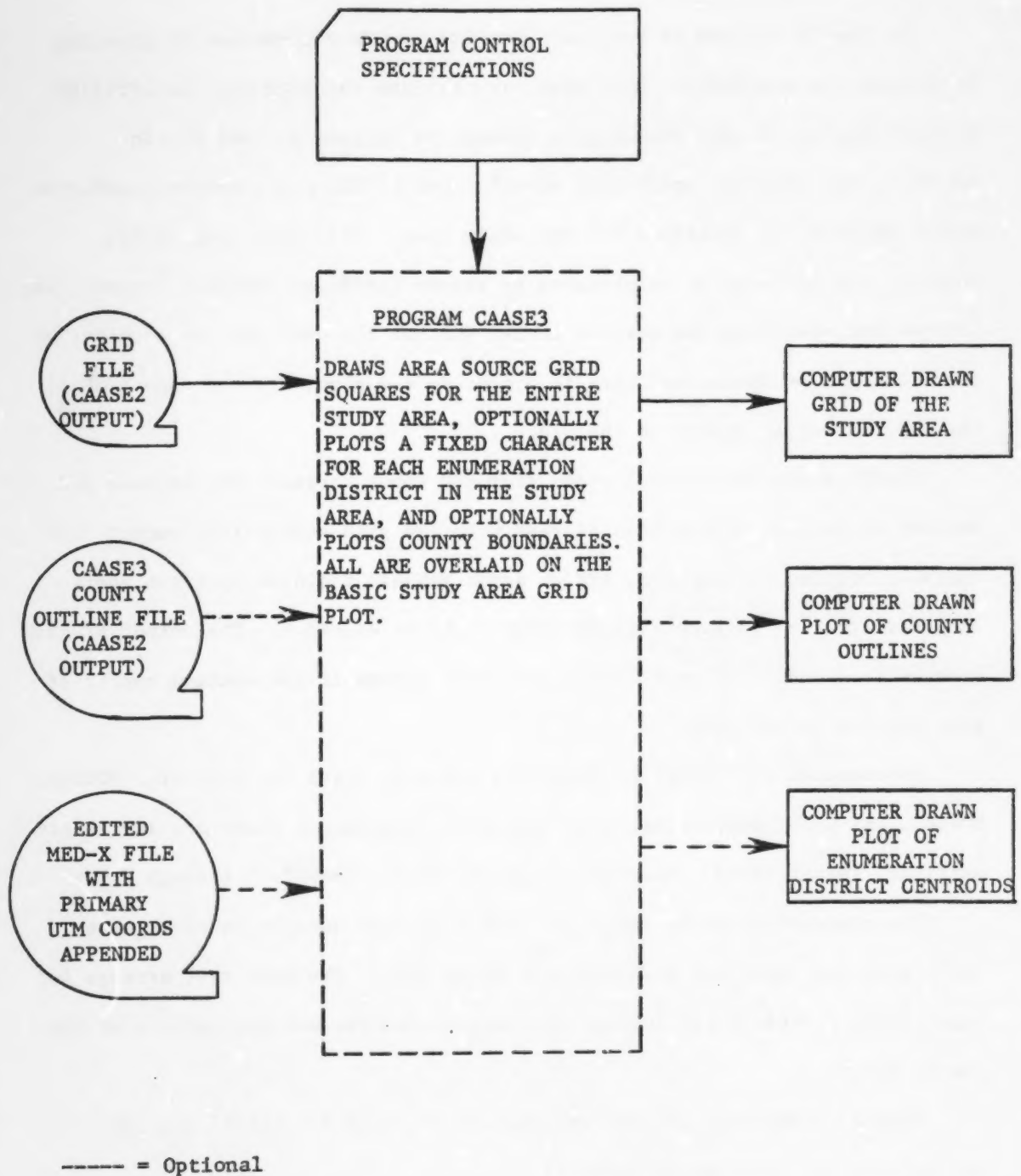


FIGURE 10. SYSTEM FLOWCHART OF CAASE3 PROGRAM

4.2 Input Information

A description of the punched card variables input in the runstream appears in Table 10. The card input includes: a scaling factor multiplier, plot request parameters for the enumeration district and county outline plotting options, and a title of up to 20 characters for labeling the plot.

Figure 11 shows the input order and deck configuration.

The grid square file output from CAASE2 is used as direct input to CAASE3. The record layouts and descriptions for this file are contained in Tables 6 and 7.

If the plotting of enumeration districts is requested, the edited MED-X file output from CAASE1 is used as direct input to CAASE3. The record layout and description of the file are shown in Table 3.

If county outlines are to be plotted, the subset of the county outline file output from CAASE2 is used as direct input to CAASE3. The record layout and description of the file are shown in Table 11.

4.3 Output Information

The CAASE3 computer-driven line plotter output contains as minimum output a frame with tick marks representing every 5-km on each axis, labels, a title, a scale legend, and the entire study area grid. County outlines and/or enumeration districts are included only at the user's request. All are plotted to the scale selected by the user. Figure 12 is an example of plotter output for the Parkersburg-Marietta AQCR (#179) example study area; the plotter output includes the grid array, enumeration districts, and county outlines.

A printer listing of all grid squares as read from the input file is provided. This listing also includes a display of the study area name for identification purposes, statements of user request of enumeration district and/or county outline plotting, the minimum and maximum easting and northing

TABLE 10. INPUT CARD LAYOUT, CAASE3

<u>Card Type</u>	<u>Card Columns</u>	<u>Format</u>	<u>Variable Name</u>	<u>Description</u>
PROGRAM CONTROL CARD	1 - 12	F12.0	SCALEX	Scale factor multiplier to convert kilometer distances to plotter inches
	13 - 24	I12	IXER	Enumeration district plot request parameter
	25 - 36	I12	ICO	County outline plot request parameter
STUDY AREA CARD	1 - 20	5A4	AQCR	Name of study area

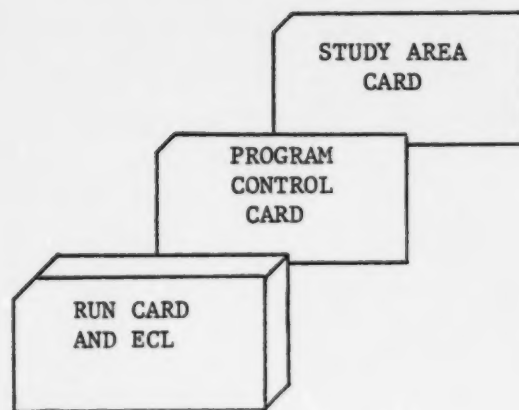


FIGURE 11. INPUT DECK CONFIGURATION FOR CAASE3 PROGRAM

TABLE 11. CAASE3 COUNTY OUTLINE FILE* RECORD LAYOUT
(FORTRAN UNIT 12)

<u>Variable</u>	<u>Format</u>	<u>Columns</u>	<u>Comments</u>
IST, IMY	I7, I3	1 - 7, 8 - 10	State and county ID. Non-zero values identify this as header record (skipped)
FROM(1), FROM(2)	F10.1, F10.1	11 - 20, 21 - 30	Start of line segment (easting, northing)
TO(1), TO(2)	F10.1, F10.1	31 - 40, 41 - 50	End of line segment (easting, northing)

*Optional CAASE2 output.

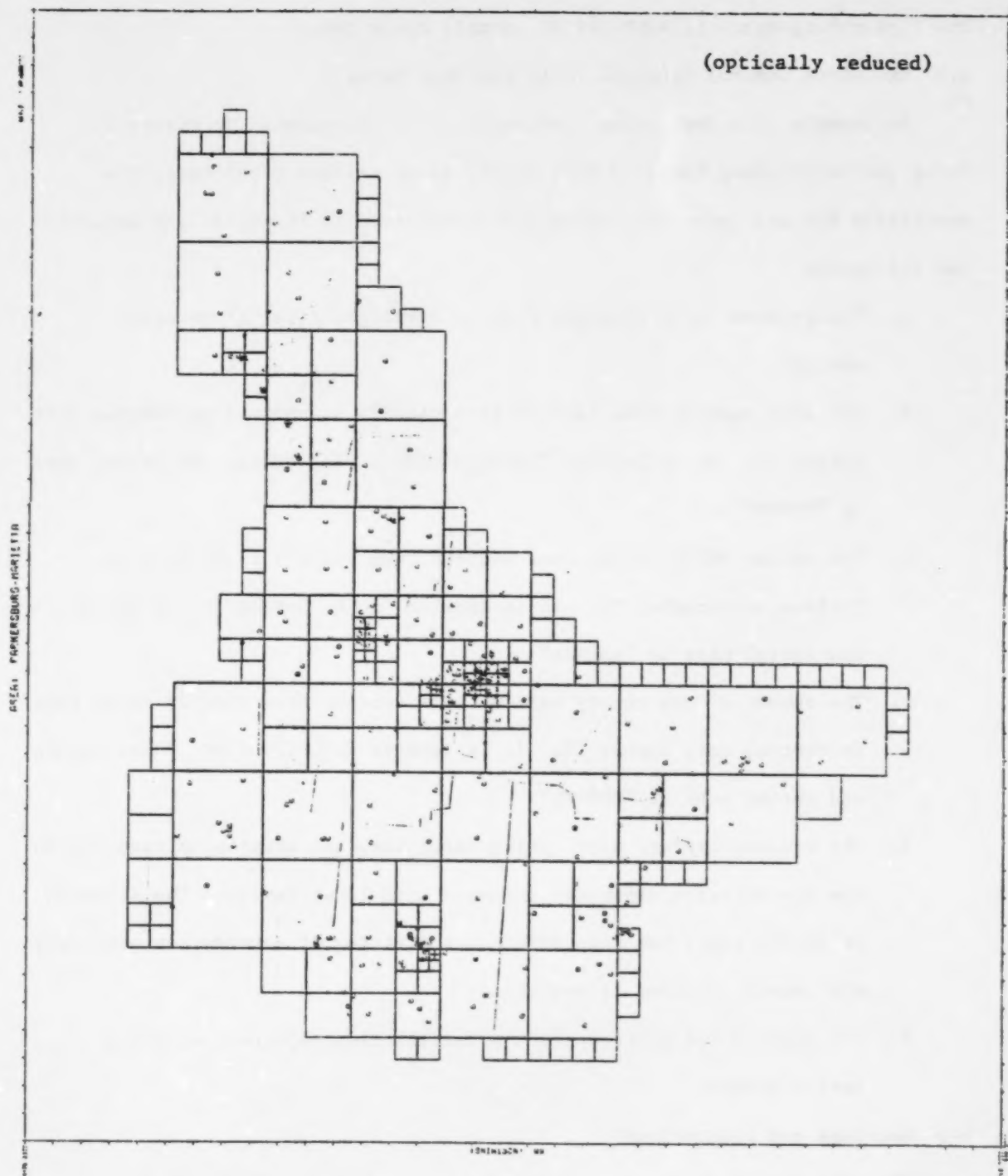


FIGURE 12. EXAMPLE OF PLOTTER OUTPUT FROM CAASE3

(in the primary UTM zone) of the grid itself, and a statement of the actual size of the plot in inches. Figure 13 is an example of the printed output for the Parkersburg-Marietta AQCR (#179) example study area.

4.4 Executive Control Language (ECL) and Deck Setup

An example of a deck setup configuration is illustrated in Figure 11. Using the Parkersburg-Marietta AQCR (#179) as an example study area, the associated ECL and input data cards are illustrated in Figure 14 and describe the following:

- A. The program is in absolute form in cataloged file "A" on mass storage.
- B. The grid squares file (output from CAASE2) is on tape as Fortran unit number 20. It is labeled "AQCR179-GRID". The volume and serial name is "FFFFFF".
- C. The edited MED-X census data (output from CAASE1) is on tape as Fortran unit number 10. It is labeled "AQCR179-MEDX". The volume and serial name is "AAAAAA".
- D. The subset of the county outline file (output from CAASE2) is on tape as Fortran unit number 12. It is labeled "AQCR179-PLOT". The volume and serial name is "HHHHHH".
- E. The scaling factor, plot option variables, and study area name are on the installation dependent standard card input device. The standard 1:250,000 scale has been selected. Plotting of enumeration districts and county outlines is requested.
- F. The printer and plotter are the installation dependent standard device numbers.

4.5 Warnings and Limitations

The user should check the size of the study area on a USGS map to determine whether the requested map scale will fit on twenty-nine (29) inch

CAASE3

STUDY AREA IS PARKERSBURG-MARIETTA

ENUMERATION DISTRICTS TO BE PLOTTED

COUNTY OUTLINES TO BE PLOTTED

EASTING NORTHING

MINIMUM 373. 4255.

MAXIMUM 565. 4415.

PLOT WILL COVER 16.1 X 13.8 INCHES

BOX	XPOINT	YPOINT	SIDE	STATE	COUNTY
1	389.0	4335.0	16.0	39	9
2	405.0	4335.0	16.0	39	9
3	421.0	4335.0	16.0	39	9
4	437.0	4343.0	8.0	39	9
5	385.0	4351.0	4.0	39	9
6	389.0	4351.0	8.0	39	9
7	397.0	4351.0	4.0	39	9
8	401.0	4351.0	2.0	39	9
9	403.0	4351.0	1.0	39	9
10	404.0	4351.0	1.0	39	9
11	405.0	4351.0	4.0	39	9
12	409.0	4351.0	4.0	39	9
13	413.0	4351.0	8.0	39	9
14	421.0	4351.0	16.0	39	9
15	403.0	4352.0	1.0	39	9

(ETC.)

273	449.0	4355.0	4.0	54	107
274	453.0	4359.0	4.0	54	107
275	457.0	4359.0	4.0	54	107
276	461.0	4359.0	4.0	54	107
277	465.0	4359.0	4.0	54	107
278	459.0	4363.0	2.0	54	107
279	461.0	4363.0	2.0	54	107

378 TOTAL ENUMERATION DISTRICTS PLOTTED

378 CENSUS ENUMERATION DISTRICTS

0 SCALED ENUMERATION DISTRICTS

0 USER ENUMERATION DISTRICTS

9 COUNTIES' OUTLINES PLOTTED.

FIGURE 13. EXAMPLE OF PRINTED OUTPUT FROM CAASE3

```

@RUN 21RC3P,acct-code/user-id,project
@PASSWD password
@ASC,A A.
@ASC,T AQCR179-GRID.,T,FFFFFF
@USE 20.,AQCR179-GRID.
@ASC,T AQCR179-MEDX.,T,AAAAAA
@USE 10.,AQCR179-MEDX.
@ASC,T AQCR179-PLOT.,T,HHHHHH
@USE 12.,AQCR179-PLOT.
@PLOT plotter-unit-no.
@XQT A.CAASE3
          1.0          1          1
PARKERSBURG-MARIETTA
@FIN

```

FIGURE 14. ECL AND INPUT DATA CARDS FOR CAASE3

wide plotter paper. The scaling factor, SCALEX, is divided into the constant 250,000 in the program to compute the map scale. A SCALEX equal to 1.0 yields a map scale of 1:250,000; 2.0 yields 1:125,000; etc. The program computes the plotting space needed and aborts with an error message if the plot will not fit on 29" wide paper. For this case a new scale is selected, e.g., 1:500,000, and the job resubmitted.

5.0 CAASE4 PROGRAM

5.1 Program Description

This program calculates apportioning factors for each area source emissions category for each grid square in the study area. The primary, but not limiting, objective of apportioning area source emissions to a sub-county grid is to provide better spatial resolution of area source emissions data for dispersion modeling analyses. (CAASE5, described in Section 6, uses the calculated apportioning factors to develop fractional coefficients used to allocate a portion of a county's total fuels and emissions to each source category-grid square combination.)

Fuels and emissions are allocated with the same apportioning factors. For example, housing counts for each grid square are used to calculate the apportioning factor for both distillate oil marketed for use as residential fuel and the emissions produced by its combustion.

CAASE4 is structured such that a main program, with only a few lines of source code, is used to set the dimensions of the arrays for the variables used. (This is done to conserve computer core storage requirements.) The main program needs to be recompiled only if array sizes are to be increased. After defining the variable dimensions, the main program calls the subroutine CAASE4, which does all of the work; the CAASE4 subroutine does not call any additional subroutines.

The program uses the grid square file output from the CAASE2 gridding program as direct input. Each county in the study area being processed is completely processed, in turn, before proceeding to the next county.

CAASE4 uses census based data and grid square size to calculate apportioning factors. This is a totally objective technique that the user can optionally modify. Objective factors used include, for each grid square: the fractional area of the grid square that is located in the county being

processed (1.0 unless a county border transects the grid square), the size and location of the grid square, and housing and population counts assigned to it for that county. From these data, population density and its inverse are calculated and also used for apportioning.

CAASE4 will use overriding weighting factors at the user's option. Most of the area source emissions categories can be effectively apportioned by CAASE4 without user intervention. For a few categories, the user will probably have data not directly available to CAASE, for example, the locations of airports, waterways, and railroads; for these categories (and any others), the user can prepare and input overriding weighting factors.

A detailed discussion of the objective apportioning factors, user-supplied overriding weighting factors, their rationale, and how to apply them, are included in Section 8. The method of introducing overriding weighting factors is discussed in Section 5.2, Input Information.

It is important for the CAASE user to fully understand a basic concept in the calculation of apportioning factors. All of the apportioning factors output from CAASE4 are "weighted apportioning factors." Each one is the product of an objective apportioning factor - for example, grid square contained population - and a weighting factor. The weighting factor is 1.0 unless overridden by the user. The CAASE user does not replace the objective apportioning factors when he uses the overriding option; he modifies the 1.0 (default) weighting factor coefficients of the objective apportioning factors.

For convenience, the fields of fuels (throughput) data on the NEDS Area Source Input Form [EPA (DUR) 219, 3/72] have been sequentially numbered by source category. Major category classifications (for example, residential fuel) and associated minor category classifications (for example, distillate

oil) have been assigned a sequential category number. Table 12 relates the assigned sequential number to its major and minor classifications.

In the CAASE4 program, objective apportioning factors have been assigned to all area source categories. The tons per acre coefficients reported for forest wildfires, managed burning, and agricultural field burning are used to calculate total county fuels (throughput) for those source categories. They are, therefore, not subject to apportioning; their numeric values are included in CAASE4 outputs for use by CAASE5. The number of days orchard heaters are fired for frost control is also output without change for use by CAASE5.

The selection of array dimensions in the main program is based on the maximum count of grid squares included in any of the counties currently being processed and on the maximum number of source categories to be overridden by user-supplied weighting factors in any of those counties.

Figure 15 is a system flowchart of the CAASE4 program. Logical flowcharts and source language listings for CAASE4 are included in Appendix D.

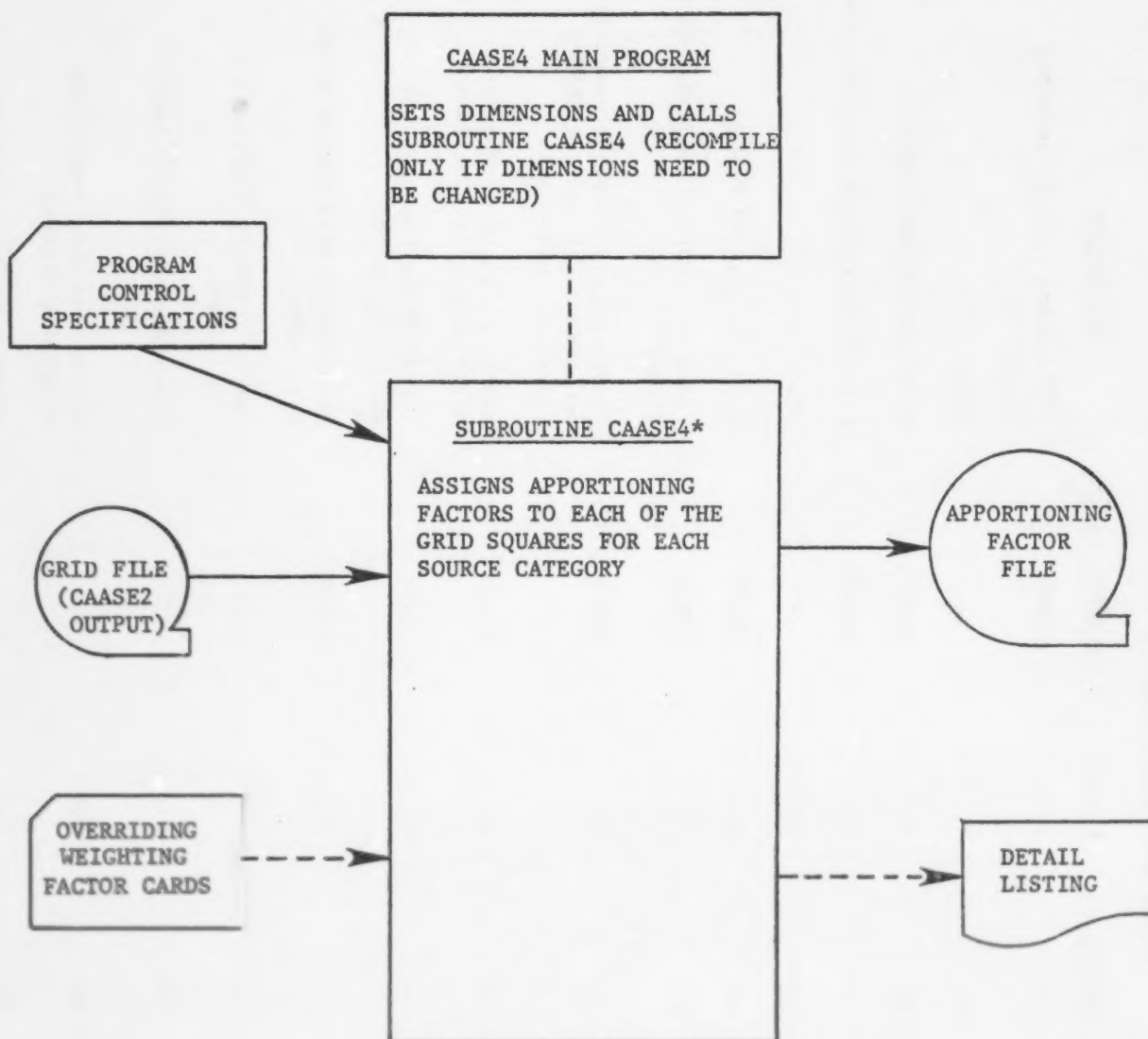
5.2 Input Information

The input card variables, their layout, and descriptions are contained in Table 13. The county selector card contains the state and county FIPS code and name, the number of source categories to be overridden (if any), and a print switch option variable used to control the printing of computed apportioning factors. If source categories are to be overridden, then the source category number and its initialization constant are input for each of them. (This initializes those grid squares; overriding values need not be read in for every grid square if only one or a few are to receive apportioned fuels and emissions. For example, if all grid squares were initialized to zero for emissions from aircraft operations, the user would read in an overriding weighting factor for only those grid squares affected by aircraft

TABLE 12. AREA SOURCE EMISSIONS CATEGORY NUMBERS

CATEGORY NUMBER	MAJOR CLASSIFICATION	MINOR CLASSIFICATION
1	RESIDENTIAL FUEL	ANTH. COAL
2	RESIDENTIAL FUEL	BITUM. COAL
3	RESIDENTIAL FUEL	DIST. OIL
4	RESIDENTIAL FUEL	RESID. OIL
5	RESIDENTIAL FUEL	NAT. GAS
6	RESIDENTIAL FUEL	WOOD
7	COMM'L & INSTTL FUEL	ANTH. COAL
8	COMM'L & INSTTL FUEL	BITUM. COAL
9	COMM'L & INSTTL FUEL	DIST. OIL
10	COMM'L & INSTTL FUEL	RESID. OIL
11	COMM'L & INSTTL FUEL	NAT. GAS
12	COMM'L & INSTTL FUEL	WOOD
13	INDUSTRIAL FUEL	ANTH. COAL
14	INDUSTRIAL FUEL	BITUM. COAL
15	INDUSTRIAL FUEL	COKE
16	INDUSTRIAL FUEL	DIST. OIL
17	INDUSTRIAL FUEL	RESID. OIL
18	INDUSTRIAL FUEL	NAT. GAS
19	INDUSTRIAL FUEL	WOOD
20	INDUSTRIAL FUEL	PROCESS GAS
21	ON-SITE INCINERATION	RESIDENTIAL
22	ON-SITE INCINERATION	INDUSTRIAL
23	ON-SITE INCINERATION	COMM'L & INSTTL
24	OPEN BURNING	RESIDENTIAL
25	OPEN BURNING	INDUSTRIAL
26	OPEN BURNING	COMM'L & INSTTL
27	GASOLINE FUEL	LIGHT VEHICLE
28	GASOLINE FUEL	LIGHT TRUCK
29	GASOLINE FUEL	HEAVY VEHICLE
30	GASOLINE FUEL	OFF HIGHWAY
31	DIESEL FUEL	HEAVY VEHICLE
32	DIESEL FUEL	OFF HIGHWAY
33	DIESEL FUEL	RAIL LOCOMOTIVE
34	AIRCRAFT	MILITARY
35	AIRCRAFT	CIVIL
36	AIRCRAFT	COMMERCIAL
37	VESSELS	COAL
38	VESSELS	DIESEL OIL
39	VESSELS	RESID. OIL
40	VESSELS	GASOLINE
41	EVAPORATION	SOLVENT PURCHASED
42	EVAPORATION	GASOLINE MARKETING
43	MEASURED VEH MILES	LIMITED ACCESS RDS
44	MEASURED VEH MILES	RURAL ROADS
45	MEASURED VEH MILES	SUBURBAN RDS
46	MEASURED VEH MILES	URBAN ROADS
47	DIRT RDS TRAVELED	...
48	DIRT AIRSTRIPS	...
49	CONSTRUCTION ACRES	...
50	MISC. WIND EROSION	...
51	LAND TILLING	...
52	FOREST WILDFIRES*	AREA-ACRES
53	MANAGED BURNING*	AREA-ACRES
54	AGRI. FIELD BURNING*	AREA-ACRES
55	FRONT CONTROL**	ORCHARD HEATERS
56	STRUCTURE FIRES	NO. PER YEAR

*Days/acre also reported; **Days fired/year also reported.



*This is "effectively" the main program; the main (driver) CAASE4 Program is used only to set dimensions and call this subroutine.

----- = Optional

FIGURE 15. SYSTEM FLOWCHART OF CAASE4 PROGRAM

TABLE 13. INPUT CARD LAYOUT, CAASE4

<u>Card Type</u>	<u>Card Columns</u>	<u>Format</u>	<u>Variable Name</u>	<u>Description</u>
COUNTY SELECTOR CARD	1 - 5	I5	KOUNTY	FIPS county code of selected county
	6 - 10	5X	--	Blank
	11 - 30	5A4	CNAME	Name of selected county
	31 - 35	I5	KSTATE	FIPS state code of selected state
	36 - 40	5X	--	Blank
	41 - 60	5A4	SNAME	Name of selected state
	61 - 65	I5	IOVER	Number of source categories to be overridden
	66 - 70	I5	ITEST	Option switch to print computed apportioning factors (ITEST=0 suppresses printing)
SOURCE CATEGORY OVERRIDE OPTION CARD	1 - 5	I5	ICAT	Source category number for overriding weighting factor
	6 - 10	F5.0	XINIT	Initializing constant for weighting factor
OVERRIDE FACTOR CARD	1 - 10	I10	IDNUM	Area source grid square to be overridden
	11 - 20	I10	KAT	Source category number to be overridden
	21 - 30	F10.0	WEIGHT	Overriding weighting factor
OVERRIDE FACTOR DELIMITER CARD	1 - 80	80X	--	Blank - no more overriding weighting factors
RUN DELIMITER CARD	1 - 80	80X	--	Blank - no more counties to be processed

operations.) An override factor card for each grid square and source category combination to be overridden is necessary. Each card contains the grid square ID number, the source category number, and the desired overriding weighting factor.

The grid square file output from CAASE2 is used directly as input to CAASE4. These data include for each grid square in the county being processed: the ID number, the fractional area of the grid square contained in "this county," the state and county FIPS number, the UTM zone number, the UTM northing and easting coordinates of the southwest corner of the grid square, the "effective side length"* in kilometers of the grid square, and the housing and population assigned to the grid square in "this county." The record layouts and description for the grid square file output from CAASE2 are contained in Tables 6 and 7 (the summary record is output for CAASE3 but is not used by CAASE4).

Figure 16 shows the input order and deck configuration for the various card types.

5.3 Output Information

Error messages, diagnostic messages, information necessary to control the CAASE5 program, and a formatted magnetic tape with grid square descriptions and their weighted apportioning factors are output. Printed output varies according to the options selected. If overriding weighting factors and initializing coefficients for the overridden source categories are input, they will also be printed. If a detailed listing is requested (i.e., the variable ITEST is non-zero), identifying information and calculated apportioning

*If the fractional area of the grid square in "this county" is less than 1.0, the "effective side length" is the square root of the area contained in "this county."

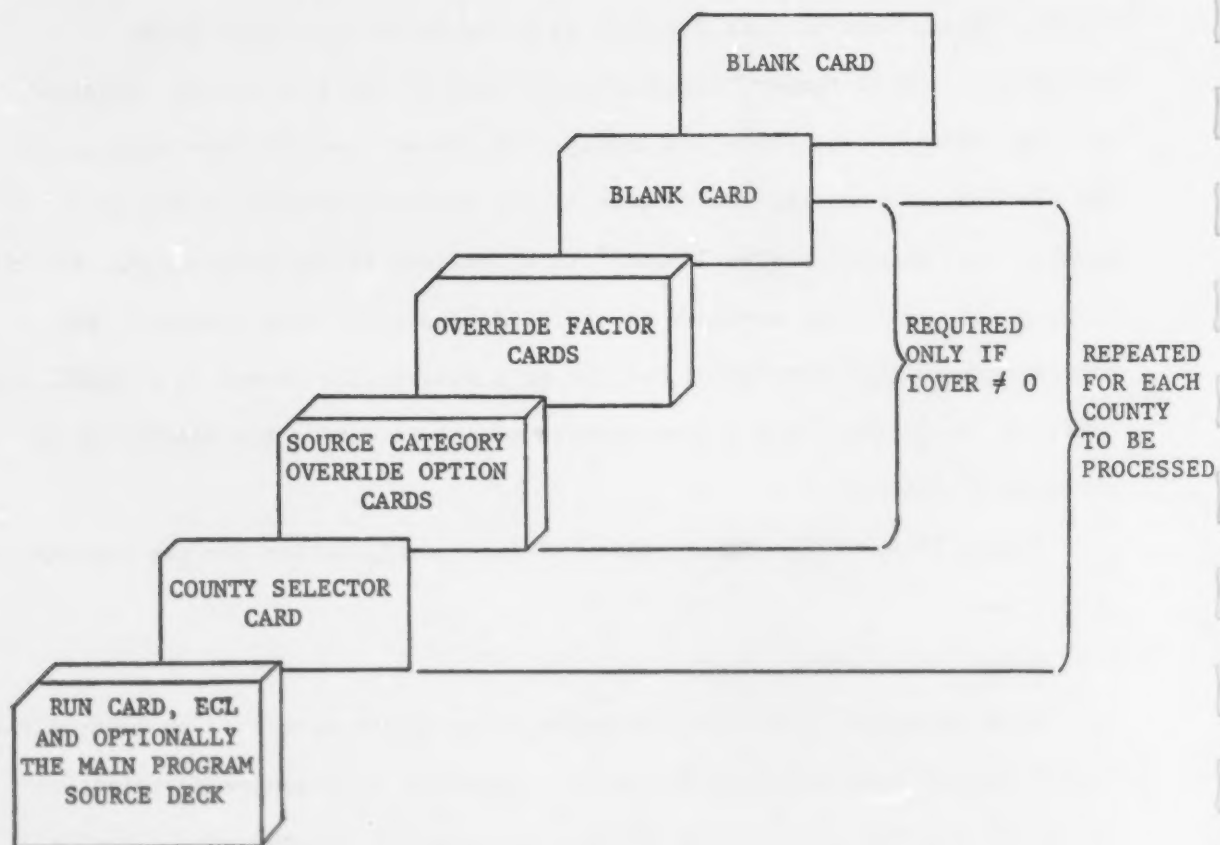


FIGURE 16. INPUT DECK CONFIGURATION FOR CAASE4 PROGRAM

factors for each grid square and source category combination will be printed. The state and county names and the number of grid squares* read in for the county are printed. Figure 17 is an example of CAASE4 printer output. (Note that no source categories were overridden.) Figure 18 is an example of a requested detailed listing for grid squares located in Washington County, Ohio. The detailed listing is printed in the same order as the grid squares are processed, which is generally by sequential ID numbers.

Figure 18 was prepared with printed output for two grid squares for purposes of the following discussion. Grid square number 97 is an 8 by 8 kilometer square containing 64 square kilometers of area; the variable FRAC (fraction) is 1.0 indicating that the entire grid square is located in Washington County; therefore, the "effective side length" is the same as the grid square side length. However, grid square number 98 is a 4 by 4 kilometer square containing 16 square kilometers of area; in this case, FRAC is 0.88633. Therefore, only 14.18 square kilometers of area are located within Washington County. The remaining area is located in one or more neighboring counties and could, in fact, be outside the study area of interest. In the case of grid square 98, the remaining 1.82 square kilometers are in Wood County, West Virginia, a neighboring county within the same AQCR. The "effective side length" for grid square number 98 is 3.7658. The calculated apportioning factors are printed (by row) in the same order as the source categories are reported (see Table 12). Again, referring to the values printed in Figure 18, note that the contained housing assigned to grid square number 97 is 488 (rounded to an integer); note that this number appears for the first five factors in the printout because the first five area source categories are

*The number of grid squares for each county is used to determine dimension requirements in the CAASE5 program.

STATE AND COUNTY OHIO	ATHENS	HAD	32 GRID SQUARES
0 SOURCE CATEGORIES WERE OVERRIDDEN			
STATE AND COUNTY OHIO	MEIGS	HAD	28 GRID SQUARES
0 SOURCE CATEGORIES WERE OVERRIDDEN			
STATE AND COUNTY OHIO	MORGAN	HAD	17 GRID SQUARES
0 SOURCE CATEGORIES WERE OVERRIDDEN			
STATE AND COUNTY OHIO	WASHINGTON	HAD	58 GRID SQUARES
0 SOURCE CATEGORIES WERE OVERRIDDEN			
STATE AND COUNTY WEST VIRGINIA	JACKSON	HAD	26 GRID SQUARES
0 SOURCE CATEGORIES WERE OVERRIDDEN			

(ETC.)

GOOD FINISH

FIGURE 17. EXAMPLE OF PRINTED OUTPUT FROM CAASE4

residential fuel and have an objective apportioning factor of housing count (see Section 8). The remaining 51 apportioning factors for grid square number 97 are for source categories 6 through 56 and include the objective apportioning factors of housing, population, area, side length, and area-weighted inverse population density. Table 14 contains the record layout and a description of all variables included in the apportioning factor file output by CAASE4.

5.4 Executive Control Language (ECL) and Deck Setup

An example of a deck setup configuration is illustrated in Figure 16. Using the Parkersburg-Marietta AQCR (#179) as an example study area, the associated ECL and input data cards are illustrated in Figure 19 and describe the following:

- A. The CAASE4 program is in absolute form in cataloged file "A" on mass storage.
- B. The grid square file (output from CAASE2) is on tape as Fortran unit number 4. It is labeled "AQCR179-GRID". The volume and serial name is "FFFFFF".
- C. The apportioning factor file will be written on tape as Fortran unit number 4. It will be labeled "AQCR179-FACT". The volume and serial name is "JJJJJJ".
- D. The county selector cards are on the installation dependent standard card input device. The counties to be processed include four in the state of Ohio and five in the state of West Virginia. No overriding weighting factors are to be input; therefore, no initializing factors are included in the input runstream. The detailed print option has been selected for Washington County, Ohio.

TABLE 14. OUTPUT RECORD LAYOUT FOR APPORTIONING FACTOR FILE, CAASE4

<u>Position</u>	<u>Format</u>	<u>Variable Name</u>	<u>Definition</u>
1 - 5	I5	ID	Grid square sequence number
6 - 11	F6.5	FRAC	Fraction of total area of grid square contained in this county
12 - 14	I3	ISTATE	FIPS state number for this grid square
15 - 34	5A4	SNAME	Name of state for this grid square
35 - 39	I5	ICNTY	FIPS county number for this grid square
40 - 59	5A4	CNAME	Name of county for this grid square
60 - 62	I3	IZONE	UTM zone of grid square coordinates (primary zone)
63 - 72	F10.0	X	UTM easting coordinate of lower left-hand corner of this grid square
73 - 82	F10.0	Y	UTM northing coordinate of lower left-hand corner of this grid square
83 - 92	F10.2	SIDE	Effective side length of this grid square for the area located in this county, i.e., the square root of the area contained in this county
93 - 102	F10.2	AREA	Area of this grid square contained in this county
103 - 830	24E13.5/ 32E13.5	FACTOR	Apportioning factors (including any overriding factors) for the 56 source categories for this grid square

@RUN 21RC4P,acct-code/user-id,project,time,pages

@PASSWD password

@ASG,A A.

@ASG,T AQCR179-GRID.,T,FFFFFF

@USE 4.,AQCR179-GRID.

@ASG,T/W AQCR179-FACT.,T,JJJJJJ

@USE 8.,AQCR179-FACT.

@XQT A.CAASE4

009	ATHENS	39	OHIO	0	0
105	MEIGS	39	OHIO	0	0
115	MORGAN	39	OHIO	0	0
167	WASHINGTON	39	OHIO	0	1
035	JACKSON	54	WEST VIRGINIA	0	0
073	PLEASANTS	54	WEST VIRGINIA	0	0
095	TYLER	54	WEST VIRGINIA	0	0
103	WETZEL	54	WEST VIRGINIA	0	0
107	WOOD	54	WEST VIRGINIA	0	0

----BLANK CARD----

@EOF

@FIN

FIGURE 19. RCL AND INPUT DATA CARDS FOR CAASE4

5.5 Warnings and Limitations

The CAASE4 main program is used to set dimensions and to pass them to the CAASE4 subroutine as "variable dimensions." The variable NDIM is related to the number of grid squares; it must be as large as the largest number of grid squares in any county currently being processed. NDIM is passed to the CAASE4 subroutine as a variable dimension. The value assigned to the Fortran Dimension statements in the main program must be at least one larger than the value assigned to NDIM. (This is necessary because whenever the CAASE4 subroutine reads the grid square file, the end of the set of grid squares for one county is signaled by reading the first record of the next county, i.e., the county ID number changes. The end-of-file condition signals the end of the set of grid squares for the last county in the file.)

Analogous to the discussion concerning the variable NDIM and the number of grid squares, is the setting of the variable KDIM in the main program. KDIM is the variable used to set the dimensions for the number of source categories to be overridden. It must be at least as large as the largest number of categories to be overridden in any county currently being processed.

Selecting the detailed print option can produce a large number of printed pages. If this option is selected for a county, 24 lines (including vertical spacing) are printed for each grid square; a sufficient output page estimate must be included on the ECL "RUN" card.

All of the counties in the study area do not have to be processed during any particular CAASE4 run; however, those counties processed must be in the same order as processed by CAASE1 and CAASE2.

If source categories are to be overridden, a careful reading and a full understanding of Section 8 cannot be overemphasized.

6.0 CAASE5 PROGRAM

6.1 Program Description

The CAASE5 program performs the functions of calculating the emissions and allocating fuels and emissions to each grid square and source category combination.

In order to perform these functions, CAASE5 requires: the apportioning factor file output from CAASE4, current area source emission factors for the five primary pollutants, and the NEDS Area Source fuels (throughput) data (for each county to be processed). These data must be in the same format as the first five cards (A1 through A5) from the NEDS Area Source Input Form [EPA (DUR) 219, 3/72].

CAASE5 is structured such that a main program, with only a few lines of source code, is used to set the dimensions of the arrays for the variables used. (This is done to conserve computer core storage requirements.) The main program needs to be recompiled only if array sizes are to be increased. After defining the variable dimensions, the main program calls the subroutine CAASE5, which does all the work; CAASE5 calls other subroutines and passes the variable dimensions to them as necessary.

CAASE5 uses the fuels (throughput) totals and the emission factors to calculate county-total area source emissions in the same way as the NEDS programs.

Current area source emission factors are input by the user. The factors can be the national emission factors published by EPA or those developed by state or local agencies. Emission factors for highway motor vehicles are input directly; those for stationary sources and off-highway mobile sources are scaled for input. The scaling of the emission factor takes into account the scaling of the fuels data and units conversion. Emission factors are read in for each of the primary pollutants (TSP, SO₂, NO_x, HC, and CO) and area source category combinations.

Except in the case of highway motor vehicle emission factors, the factors are scaled and units are converted off-line. For example, if the emission factor is 20 pounds of TSP produced for each ton of bituminous coal burned for home heating, and the total tons burned is expressed in tens of tons on the NEDS area source form, then the factor read in should be 0.10 (10 scaling factor $\times$ 20 lbs/ton burned/2000 lbs/ton). The program subsequently multiplies the fuel total reported on the area source input form by the 0.10 factor yielding TSP emissions in tons. For those source-category/pollutant combinations where percent ash or sulfur content is used, the program automatically applies them during the on-line calculation. For those categories involving acres burned, the tons per acre reported is used in the calculation of emissions. (An example of a complete set of emission factors for input to CAASE5 is included in Section 6.2.)

A complete discussion of input, output, deck setup, and formats is included in Sections 6.2 through 6.4.

It is important to understand the sequence of steps performed by CAASE5 and the algorithms used; they are described as follows, and the steps are repeated for each county being processed. Initially, identification information for the state, county, study area, and the number of grid squares in the county are read in from cards. A card with labeling information is then read in and the subroutine READ1, which is described in Section 7.30, is called to read the county "fuels" totals from cards. These cards are coded in the same format as the first five cards on the NEDS Area Source Input Form [EPA (DUR) 219, 3/72]. If READ1 does not return an error condition, processing continues. The apportioning factor file output from the CAASE4 program is then read.

At this point in the processing, the apportioning factors are not fractions that can be used as coefficients for the county totals of fuels and

emissions; that is, each is a calculated value, one for each grid square and source category combination. Using any one source category and county as an example of the procedure, and supposing that the county contained 50 grid squares, then the steps are as follows: the apportioning factors for all 50 grid squares for this source category are summed; (this becomes the denominator of a fraction). CAASE5 then allocates to the first grid square a fractional portion of the county total fuels for this source category; the fraction is the apportioning factor for the first grid square divided by the sum of the 50 apportioning factors for this source category for this county. The processing proceeds until an allocation has been made (for this source category) to each of the 50 grid squares.

In a sense, the apportioning factors output from CAASE4 appear dimensionless to CAASE5. Regardless of the numeric range of the apportioning factors for a source category, fractions are calculated by CAASE5. A summation of these fractions for a source category and for all grid squares in a county will yield unity. (After calculating county totals of emissions for each pollutant and source category combination, CAASE5 allocates them to the grid squares in the same manner as was done with the fuels.)

After the fuels have been allocated for all categories, the subroutine OUTPT1 is called which causes the printing of tables. (OUTPT1 is described in Section 7.31.) The CAASE5 program then calculates total emissions for each of the five primary pollutants (TSP, SO₂, NO_x, HC, and CO) for each of the fuel categories. The CAASE5 program handles the highway motor vehicle source categories in the same manner as the AEROS-NADB program for the NEDS system. Measured vehicle miles by vehicle class is used, if available, and the ratios for vehicle classes are calculated using estimates of miles per gallon of fuel used for each of the different vehicle classes. The emissions are then

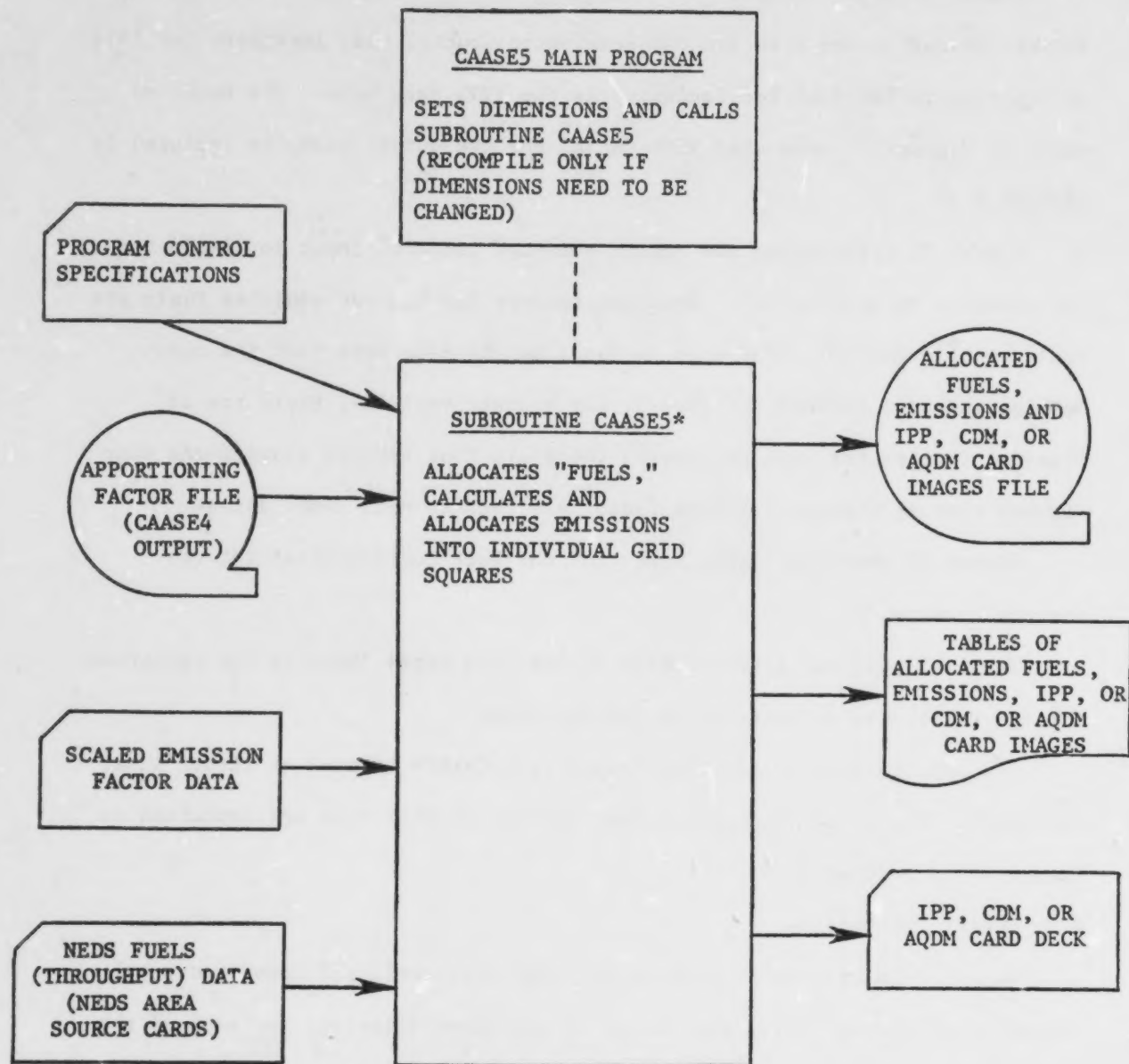
allocated one pollutant at a time to limit the computer core storage requirements. The emissions for all area source emission categories for the county are summed and printed for comparison with the total emissions calculated by the NEDS system for area sources. The TSP, SO₂, NO_x, HC, and CO emissions for all source categories are summed for each grid square and saved for the dispersion modeling input cards to be output later using the OUTPT3 subroutine. (OUTPT3 is described in Section 7.33.) The allocated emissions are printed in tabular form using the OUTPT2 subroutine. (OUTPT2 is described in Section 7.32.) After allocated emissions are output for all five pollutants, the dispersion modeling input card images are produced by calling the OUTPT3 subroutine. A formatted tape is written containing all table entries and is described, in detail, in Section 6.3.

Logical flowcharts and source language listings for CAASE5 and its subroutines are included in Appendix E.

Figure 20 is a system flowchart of the CAASE5 program.

6.2 Input Information

Emission factors and a dispersion model selector card are read; they will be used for all counties to be processed. For each county to be processed, a county selector card, a heading card for labeling output, and county-total area source fuels (throughput) data are read. The fuels (throughput) data is input in the same format as the first five cards (A1 through A5) on the NEDS Area Source Input Form [EPA (DUR) 219, 3/72]. Subroutine READ1 performs the function of reading the area source fuels (throughput) cards. READ1 also calculates the "light truck, gasoline fuel" fuels total for the county. (See Section 7.30 for the algorithm used.) This source category is not directly reported on the area source form; the algorithm used by READ1 was obtained from EPA/NADB.



*This is "effectively" the main program; the main (driver) CAASE5 program is used only to set dimensions and call this subroutine.

----- = Optional

FIGURE 20. SYSTEM FLOWCHART OF CAASE5 PROGRAM

Figure 21 is an example of a completed NEDS Area Source Form. The data values entered on the form are the Washington County, Ohio inventory for 1972 as reported to EPA/NADB for inclusion in the NEDS data base. The data, as shown in Figure 21, were used with CAASE5 for the output examples included in Section 6.3.

Figure 22 illustrates the scaled emission factors* input to CAASE5 for the examples in this manual. Emission factors for highway vehicles fuels are scaled within CAASE5. (The user is cautioned to make sure that the most current emission factors are used.) For highway vehicles, there are 16 emission factors for each pollutant; there are four vehicle classes and four highway classes with an emission factor assigned to each combination.

Figure 23 shows the input order and the deck configuration for the various card types.

Table 15 contains a description of the card types input in the runstream, their formats, and definitions of the variables.

The apportioning factor file output from CAASE4 is used as direct input to CAASE5. The record layout and description for this file are contained in Table 14 (in Section 5.3).

6.3 Output Information

Output from the CAASE5 program includes diagnostic and error messages, tables of allocated fuels, and tables of allocated emissions for each of the five primary pollutants. A card deck (or card images) is produced in the input format for the IPP, CDM, or AQDM dispersion models. A formatted tape is written containing table entries, and the card images are also written on this

*The CAASE5 program logic automatically takes into account the ash and sulfur content for the appropriate source categories.

.05	.10	.05	.115	.05	1.25	.01	.029
.075	.115	.05	1.25	.01	.065	.001	.075
.115	.05	1.25	.1	.16	.4	.4	.8
.8	.995	0.	0.	0.	.00535	0.	.1665
.125	.002845	.00895	.00895	.1	.12	.0965	0.
0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	.0085	.0085	.0085	.0085	.0001	.054
.184	.19	.72	.795	.003	.075	.1925	.19
.72	.795	.003	.075	.1925	.19	.019	.76
.795	.003	.075	.01	.0025	.125	.125	.05
.05	.05	0.	0.	0.	.0028	0.	.149
.285	.19	.000565	.0128	.25	.15	1.43	.00315
0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	.00005	.0001
.015	.015	.06	.2	.4	.5	.05	.046
.3	.3	.6	.5	.075	.075	.005	.3
.3	.9	.5	1.15	.005	.15	.15	.3
.3	.3	0.	0.	0.	.061	0.	1.845
1.85	.478	.00257	.126	.015	1.12	.209	.0137
0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	.002	.001	.001	0.	.0047
.0125	.1	.015	.015	.04	1.	.001	.01
.015	.015	.04	1.	.001	.005	.0001	.015
.015	.015	1.	.15	.45	.25	.25	1.5
1.5	1.5	0.	0.	0.	.172	0.	.202
.47	2.315	.0126	.1655	.1	.294	.0145	.4655
1.	1.1	0.	0.	0.	0.	0.	0.
0.	0.	0.	.012	.01	.01	.0215	.014

*Order of scaled factor is by row and column in the same order as in Table 12. Zero fillers are used when the emission factor has not been determined, e.g., category 48, or is not directly applicable, e.g., categories 43 through 46.

FIGURE 22. SCALED AREA SOURCE EMISSION FACTORS USED AS INPUT TO CAA5 FOR THE CAA5 EXAMPLES.

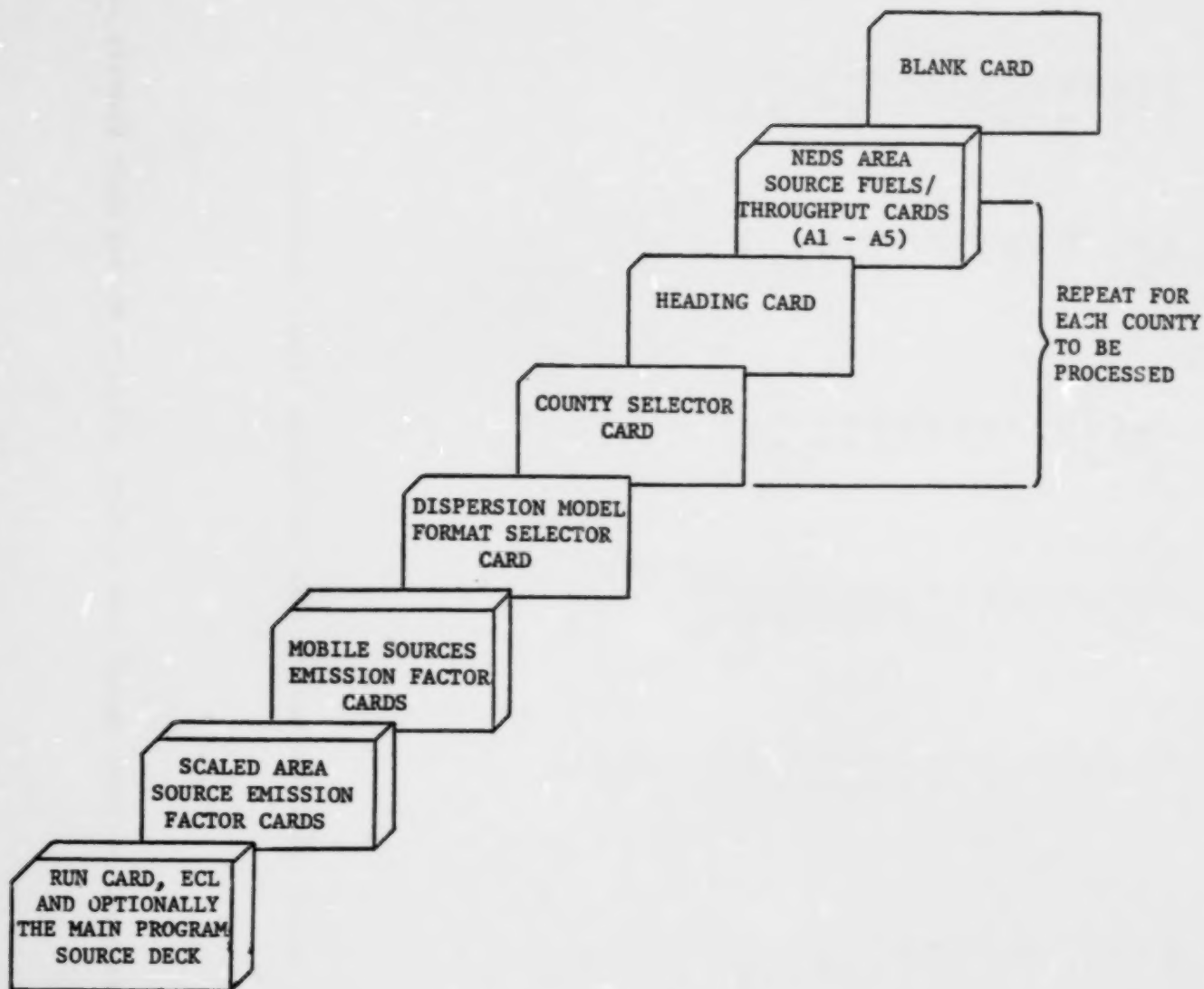


FIGURE 23. INPUT DECK CONFIGURATION FOR CAASES PROGRAM

TABLE 15. INPUT CARD LAYOUT, CAASE5

<u>Card Type</u>	<u>Card Columns</u>	<u>Format</u>	<u>Variable Name</u>	<u>Description</u>
SCALED EMISSION FACTOR CARD	1 - 80	8F10.0	EMFAC1-EMFAC5	8 emission factors per card for 56 source categories, 7 cards per pollutant, 5 pollutants
MOBILE SOURCES EMISSION FACTOR CARD	1 - 80	8F10.0	EFHV	8 emission factors per card for 4 vehicle classes, 4 road types, 2 cards per pollutant, 5 pollutants
DISPERSION MODEL FORMAT SELECTOR CARD	1 - 5	I5	IWANT	Code denoting subroutine OUTPUT3 output format IWANT = 1 IPP = 2 CDM = 3 AQDM
COUNTY SELECTOR CARD*	1 - 10	F10.0	XSTATE	FIPS state code of selected state
	11 - 20	I10	ICNTY	FIPS county code of selected county
	21 - 30	F10.0	XAQCR	Numeric code number of selected study area
	31 - 40	I10	NAREAS	Number of grid squares in selected county
	41 - 46	6X	--	Blank
	47 - 50	A4	CNTY	Name of selected county
	51 - 55	I5	KOUNTY	NEDS county code of selected county
	56 - 60	I5	KSTATE	NEDS state code of selected state
	61 - 69	9X	--	Blank
	70	A1	IPOLIT	Political subdivision of selected study area

*For the processing of more than one county, repeat card setup from this card type through card type fuels (throughput) totals.

TABLE 15. INPUT CARD LAYOUT, CAASE5 (CONT.)

<u>Card Type</u>	<u>Card Columns</u>	<u>Format</u>	<u>Variable Name</u>	<u>Description</u>
COUNTY SELECTOR CARD (CONT.)	71 - 77	7X	--	Blank
	78 - 80	A3	IREGN	Alpha code number of selected study area
HEADING CARD	1 - 80	20A4	HDG	Output page heading including name of selected county, state and any other pertinent identifying information
FUELS (THROUGHPUT) CARD	1 - 80	See NEDS AREA SOURCE INPUT FORMAT		NEDS area source fuels (throughput) cards A1 - A5
RUN DELIMITER CARD	1 - 80	80X	--	Blank - No more counties to be processed

tape. County totals, by source category and pollutant combination, are both printed and written on tape. Fuel totals from the area source input cards are printed for convenience and visual checking. Figure 24 is an example of a printout of the NEDS area source fuels (throughput) data read in for Washington County, Ohio.

The OUTPT1 subroutine outputs tables of allocated fuels (throughput) for each source category and grid square combination; Figures 25 through 29 are examples of output Tables 1 through 5 of allocated fuels for Washington County, Ohio.

The OUTPT2 subroutine outputs tables of allocated emissions for each source category and grid square combination. The OUTPT2 subroutine is called five times for each county, that is, once for each pollutant. Figures 30 through 34 are examples of output Tables 1 through 5 of allocated emissions (particulates) for Washington County, Ohio. Allocated emissions for the other four pollutants are output in the same format as the particulates.

Figure 35 is an example printout of county-total emissions for all source category and pollutant combinations for Washington County, Ohio. The county emissions totals calculated by CAASE5 for each pollutant is also printed.

Figure 36 is an example printout produced by the OUTPT3 subroutine. In this example, dispersion modeling input card images are in the IPP format. Cards are also punched, and the card images are written on the formatted CAASE5 output tape. (The OUTPT3 subroutine is described in Section 7.33.)

The formats of the CAASE5 output tape records are contained in Table 16; a description of the contained variables is given in Table 17. Tables 16 and 17 also include the sources of each of the various record types. OUTPT1 and OUTPT2 write a header record each time the subroutines are called; each header record is followed by detailed records containing allocated fuels or allocated

WASHINGTON COUNTY, OHIO (PARKERSBURG-MARIETTA AQCR - NEDS 1972) TEST 1/78

FUEL TOTALS READ IN FOLLOW - (NOTE THAT READ1 ROUTINE CALCULATED THE LGT TRUCKS CATEGORY (NO.28) BY APPORTIONING FROM LGT DUTY GAS (NO. 27) AND HWY DUTY GAS TRUCKS (NO.29))

36.0	335.0	128.0	0.0	274.0	4.0	0.0	686.0	383.0	0.0
33.0	0.0	0.0	2404.0	0.0	47.0	0.0	48.0	0.0	0.0
509.0	70.0	17.0	39.0	35.0	13.0	17716.3	3564.1	2935.6	1747.0
2121.0	376.0	7.0	0.0	432.0	0.0	0.0	443.0	0.0	60.0
309.0	270.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	229.0				

FOOTNOTE: CATEGORIES BY ROW IN SAME ORDER AS AREA SOURCE NEDS FORM AND OUTPUT TABLES

FIGURE 24. EXAMPLE PRINTOUT OF AREA SOURCE INPUT DATA, CAASE5

WASHINGTON COUNTY, OHIO (PARKERSBURG-MARIETTA AQCR - NEDS 1972) TEST 1/78

COUNTY-WIDE AREA SOURCE DATA USED IN CALCULATING EMISSIONS BY SOURCE CATEGORY FOR APPORTIONING

SULFUR CONTENT:

ANTHRACITE COAL	=	0.0 PERCENT
BITUMINOUS COAL	=	4.4 PERCENT
DISTILLATE OIL	=	0.1 PERCENT
RESIDUAL OIL	=	0.9 PERCENT

ASH CONTENT:

ANTHRACITE COAL	=	0.0 PERCENT
BITUMINOUS COAL	=	18.4 PERCENT

FOREST WILDFIRES	=	0.0 TONS PER ACRE
MANAGED BURNING	=	0.0 TONS PER ACRE
AGRICUL. FIELD BURNING	=	0.0 TONS PER ACRE
FROST CONTROL	=	0.0 TONS PER ACRE

POPULATION CODE = 4

FIGURE 24. EXAMPLE PRINTOUT OF AREA SOURCE INPUT DATA, CAASE5 (CONT.)

UNCE NUMBER	REGION	POLIT JURIS	COUNTY	COORDINATES		(SQ.KM)	***** RESIDENTIAL FUEL *****										WOOD	
				X(KM)	Y(KM)		ANTH. 10E1T	BITUM. 10E1T	DIST.OIL 10E4GALS	RES.OIL 10E4GALS							NAT.GAS 10E7FT3	10E2T
78	179		WASH	421.0	4335.0	12.30	0.1	1.4	0.5	0.0	1.1	0.0	0.0	0.0	0.0	0.0		
79	179		WASH	437.0	4335.0	1.16	0.0	0.3	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0		
80	179		WASH	437.0	4343.0	35.39	0.8	7.9	3.0	0.0	6.4	0.0	0.0	0.0	0.1	0.1		
81	179		WASH	445.0	4347.0	10.65	2.6	24.4	9.3	0.0	20.0	0.0	0.0	0.0	0.3	0.3		
82	179		WASH	449.0	4347.0	2.49	0.7	6.3	2.4	0.0	5.2	0.0	0.0	0.0	0.1	0.1		
83	179		WASH	421.0	4351.0	147.29	1.1	9.9	3.8	0.0	8.1	0.0	0.0	0.0	0.1	0.1		
84	179		WASH	437.0	4351.0	64.00	1.2	11.5	4.4	0.0	9.4	0.0	0.0	0.0	0.1	0.1		
85	179		WASH	445.0	4351.0	16.00	0.3	2.7	1.1	0.0	2.2	0.0	0.0	0.0	0.1	0.1		
86	179		WASH	449.0	4351.0	3.74	0.0	0.5	0.2	0.0	0.4	0.0	0.0	0.0	0.0	0.0		
87	179		WASH	453.0	4351.0	1.98	0.0	0.3	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.0		
88	179		WASH	461.0	4351.0	4.95	0.4	4.1	1.6	0.0	3.4	0.0	0.0	0.0	0.0	0.0		
89	179		WASH	469.0	4351.0	4.30	0.2	1.9	0.7	0.0	1.5	0.0	0.0	0.0	0.0	0.0		
90	179		WASH	485.0	4351.0	1.00	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
91	179		WASH	451.0	4352.0	0.18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
92	179		WASH	449.0	4353.0	4.00	0.1	0.5	0.2	0.0	0.4	0.0	0.0	0.0	0.0	0.0		
93	179		WASH	451.0	4353.0	1.19	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0		
94	179		WASH	445.0	4355.0	16.00	0.3	3.1	1.2	0.0	2.5	0.0	0.0	0.0	0.0	0.0		
95	179		WASH	449.0	4355.0	14.44	0.2	2.3	0.9	0.0	1.6	0.0	0.0	0.0	0.0	0.0		
96	179		WASH	437.0	4359.0	64.00	0.4	3.9	1.5	0.0	3.2	0.0	0.0	0.0	0.0	0.0		
97	179		WASH	445.0	4359.0	64.00	1.0	9.0	3.4	0.0	7.3	0.0	0.0	0.0	0.0	0.0		
98	179		WASH	453.0	4359.0	14.18	0.5	4.4	1.7	0.0	3.6	0.0	0.0	0.0	0.1	0.1		
99	179		WASH	457.0	4359.0	3.04	1.3	12.2	4.7	0.0	10.0	0.0	0.0	0.0	0.1	0.1		
100	179		WASH	461.0	4359.0	3.75	1.1	10.5	4.0	0.0	8.6	0.0	0.0	0.0	0.1	0.1		
101	179		WASH	465.0	4359.0	15.15	0.7	6.7	2.6	0.0	5.5	0.0	0.0	0.0	0.1	0.1		
102	179		WASH	469.0	4359.0	61.71	0.9	8.2	3.2	0.0	6.7	0.0	0.0	0.0	0.1	0.1		
103	179		WASH	477.0	4359.0	35.86	0.6	5.4	2.1	0.0	4.5	0.0	0.0	0.0	0.1	0.1		
104	179		WASH	453.0	4363.0	16.00	0.6	5.6	2.1	0.0	4.6	0.0	0.0	0.0	0.1	0.1		
105	179		WASH	457.0	4363.0	4.00	0.6	6.0	2.3	0.0	4.9	0.0	0.0	0.0	0.1	0.1		
106	179		WASH	459.0	4363.0	3.95	3.1	28.8	11.0	0.0	23.6	0.0	0.0	0.0	0.1	0.1		
107	179		WASH	461.0	4363.0	3.88	2.1	19.6	7.5	0.0	16.0	0.0	0.0	0.0	0.2	0.2		
108	179		WASH	463.0	4363.0	4.00	0.4	3.4	1.3	0.0	2.7	0.0	0.0	0.0	0.0	0.0		
109	179		WASH	465.0	4363.0	16.00	0.4	3.7	1.4	0.0	3.1	0.0	0.0	0.0	0.0	0.0		
110	179		WASH	457.0	4365.0	4.00	0.7	6.1	2.3	0.0	5.0	0.0	0.0	0.0	0.1	0.1		
111	179		WASH	459.0	4365.0	4.00	0.5	4.9	1.9	0.0	4.0	0.0	0.0	0.0	0.1	0.1		
112	179		WASH	461.0	4365.0	4.00	0.9	8.7	3.3	0.0	7.1	0.0	0.0	0.0	0.1	0.1		
113	179		WASH	463.0	4365.0	4.00	0.1	1.1	0.4	0.0	0.9	0.0	0.0	0.0	0.1	0.1		
114	179		WASH	421.0	4367.0	55.10	0.2	1.9	0.7	0.0	1.5	0.0	0.0	0.0	0.0	0.0		
115	179		WASH	437.0	4367.0	60.69	0.8	7.6	2.9	0.0	6.3	0.0	0.0	0.0	0.1	0.1		
116	179		WASH	445.0	4367.0	64.00	0.9	8.4	3.2	0.0	6.9	0.0	0.0	0.0	0.1	0.1		
117	179		WASH	453.0	4367.0	64.00	2.0	18.7	7.2	0.0	15.3	0.0	0.0	0.0	0.1	0.1		
118	179		WASH	461.0	4367.0	64.00	1.2	11.4	4.3	0.0	9.3	0.0	0.0	0.0	0.1	0.1		
119	179		WASH	469.0	4367.0	254.55	1.3	12.1	4.6	0.0	9.9	0.0	0.0	0.0	0.1	0.1		
120	179		WASH	485.0	4367.0	47.13	0.4	3.7	1.4	0.0	3.0	0.0	0.0	0.0	0.0	0.0		
121	179		WASH	493.0	4367.0	1.53	0.0	0.2	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0		
122	179		WASH	437.0	4375.0	53.42	0.9	8.7	3.3	0.0	7.1	0.0	0.0	0.0	0.1	0.1		

FIGURE 25. EXAMPLE OF CAASE5 OUTPUT TABLE 1, ALLOCATED FUELS

SOURCE NUMBER	COUNTY	***** ANTH. BITUM. 10E1T 10E1T	***** RES.OIL 10E4GALS 10E4GALS	***** NAT.GAS 10E7FT3 10E7FT3	***** WOOD 10E2T 10E2T	***** INDUSTRIAL FUEL ANTH. BITUM. 10E1T 10E1T	***** COKE 10E1T 10E1T	***** DIST.OIL 10E4GALS 10E4GALS	***** RES.OIL 10E4GALS 10E4GALS	***** NAT.GAS 10E7FT3 10E7FT3	***** WOOD 10E2T 10E2T	***** PROC.GAS 10E7FT3 10E7FT3
78	WASH	0.0	2.9	1.6	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.0
79	WASH	0.0	0.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80	WASH	0.0	17.1	9.5	0.0	0.8	0.0	0.0	0.0	1.2	0.0	0.0
81	WASH	0.0	51.2	28.6	0.0	2.5	0.0	0.0	0.0	3.6	0.0	0.0
82	WASH	0.0	13.0	7.3	0.0	0.6	0.0	0.0	0.0	0.9	0.0	0.0
83	WASH	0.0	20.0	11.2	0.0	1.0	0.0	0.0	0.0	1.4	0.0	0.0
84	WASH	0.0	25.0	14.0	0.0	1.2	0.0	0.0	0.0	1.8	0.0	0.0
85	WASH	0.0	6.1	3.4	0.0	0.3	0.0	0.0	0.0	0.4	0.0	0.0
86	WASH	0.0	1.0	0.6	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
87	WASH	0.0	0.7	0.4	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
88	WASH	0.0	9.0	5.0	0.0	0.4	0.0	0.0	0.0	0.6	0.0	0.0
89	WASH	0.0	4.1	2.3	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.0
90	WASH	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
91	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
92	WASH	0.0	1.1	0.6	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0
93	WASH	0.0	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
94	WASH	0.0	6.8	3.8	0.0	0.3	0.0	0.0	0.0	0.5	0.0	0.0
95	WASH	0.0	5.1	2.8	0.0	0.2	0.0	0.0	0.0	0.4	0.0	0.0
96	WASH	0.0	8.6	4.8	0.0	0.4	0.0	0.0	0.0	0.6	0.0	0.0
97	WASH	0.0	21.0	11.7	0.0	1.0	0.0	0.0	0.0	1.5	0.0	0.0
98	WASH	0.0	9.9	5.5	0.0	0.5	0.0	0.0	0.0	0.7	0.0	0.0
99	WASH	0.0	28.1	14.6	0.0	1.3	0.0	0.0	0.0	1.8	0.0	0.0
100	WASH	0.0	18.0	10.1	0.0	0.9	0.0	0.0	0.0	1.3	0.0	0.0
101	WASH	0.0	14.4	8.0	0.0	0.7	0.0	0.0	0.0	1.0	0.0	0.0
102	WASH	0.0	17.3	9.7	0.0	0.8	0.0	0.0	0.0	1.2	0.0	0.0
103	WASH	0.0	10.5	5.8	0.0	0.5	0.0	0.0	0.0	0.7	0.0	0.0
104	WASH	0.0	12.8	7.1	0.0	0.6	0.0	0.0	0.0	0.9	0.0	0.0
105	WASH	0.0	11.8	6.6	0.0	0.6	0.0	0.0	0.0	0.8	0.0	0.0
106	WASH	0.0	48.6	27.1	0.0	2.3	0.0	0.0	0.0	3.3	0.0	0.0
107	WASH	0.0	47.9	26.8	0.0	2.3	0.0	0.0	0.0	3.4	0.0	0.0
108	WASH	0.0	6.2	3.5	0.0	0.3	0.0	0.0	0.0	0.4	0.0	0.0
109	WASH	0.0	8.3	4.6	0.0	0.4	0.0	0.0	0.0	0.6	0.0	0.0
110	WASH	0.0	10.6	5.9	0.0	0.5	0.0	0.0	0.0	0.7	0.0	0.0
111	WASH	0.0	9.0	5.0	0.0	0.4	0.0	0.0	0.0	0.6	0.0	0.0
112	WASH	0.0	15.7	8.7	0.0	0.8	0.0	0.0	0.0	1.1	0.0	0.0
113	WASH	0.0	2.3	1.3	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.0
114	WASH	0.0	4.0	2.2	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.0
115	WASH	0.0	16.9	9.4	0.0	0.8	0.0	0.0	0.0	1.2	0.0	0.0
116	WASH	0.0	18.8	10.6	0.0	0.9	0.0	0.0	0.0	1.3	0.0	0.0
117	WASH	0.0	39.8	22.2	0.0	1.9	0.0	0.0	0.0	2.7	0.0	0.0
118	WASH	0.0	24.1	13.5	0.0	1.2	0.0	0.0	0.0	1.7	0.0	0.0
119	WASH	0.0	24.7	13.8	0.0	1.2	0.0	0.0	0.0	1.7	0.0	0.0
120	WASH	0.0	6.8	3.8	0.0	0.3	0.0	0.0	0.0	0.5	0.0	0.0
121	WASH	0.0	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
122	WASH	0.0	17.4	9.7	0.0	0.8	0.0	0.0	0.0	1.2	0.0	0.0

FIGURE 26. EXAMPLE OF CAASE5 OUTPUT TABLE 2, ALLOCATED FUELS

SOURCE NUMBER	COUNTY	ON SITE INCINERATION *				***** OPEN BURNING ****				***** GASOLINE FUEL *****				***** DIESEL FUEL *****			
		RESID.	INDUST.	C-INST.	RESID.	INDUST.	C-INST.	LT.VEH.	LT.TRUK	MT.VEH.	OFF HWY	MT.VEH.	OFF HWY	MT.VEH.	OFF HWY	MT.VEH.	OFF HWY
		10E1T	10E1T	10E1T	10E1T	10E1T	10E1T	10E3GAL	10E3GAL	10E3GAL	10E3GAL	10E3GAL	10E3GAL	10E3GAL	10E3GAL	10E3GAL	10E3GAL
78	WASH	2.1	0.3	0.1	0.2	0.1	0.1	73.8	14.9	12.2	9.9	8.8	2.1	0.1	0.1	0.1	0.1
79	WASH	9.4	0.1	0.0	0.0	0.0	0.0	15.1	3.0	2.5	0.4	1.8	0.1	0.0	0.0	0.0	0.0
80	WASH	11.9	1.7	0.4	0.9	0.9	0.3	440.5	88.6	73.0	13.7	52.7	3.0	0.2	0.2	0.2	0.2
81	WASH	37.1	5.2	1.3	2.8	2.6	1.0	1323.5	266.3	219.3	0.4	158.4	0.1	0.1	0.1	0.1	0.1
82	WASH	9.6	1.3	0.3	0.7	0.7	0.2	335.5	67.5	55.6	0.1	40.2	0.0	0.0	0.0	0.0	0.0
83	WASH	15.0	2.0	0.5	1.1	1.0	0.4	516.6	103.9	85.6	203.0	61.8	43.7	0.3	0.3	0.3	0.3
84	WASH	17.5	2.6	0.6	1.3	1.3	0.5	646.6	130.1	107.1	30.6	77.4	6.6	0.2	0.2	0.2	0.2
85	WASH	4.2	0.6	0.2	0.3	0.3	0.1	158.0	31.8	26.2	7.8	18.9	1.7	0.1	0.1	0.1	0.1
86	WASH	0.7	0.1	0.0	0.1	0.1	0.0	26.5	5.3	4.4	2.6	3.2	0.6	0.1	0.1	0.1	0.1
87	WASH	0.5	0.1	0.0	0.0	0.0	0.0	18.7	3.8	3.1	1.0	2.2	0.2	0.0	0.0	0.0	0.0
88	WASH	6.2	0.9	0.2	0.5	0.5	0.2	231.5	46.6	38.4	0.5	27.7	0.1	0.1	0.1	0.1	0.1
89	WASH	2.9	0.4	0.1	0.2	0.2	0.1	105.7	21.3	17.5	0.8	12.7	0.2	0.1	0.1	0.1	0.1
90	WASH	0.1	0.0	0.0	0.0	0.0	0.0	2.5	0.5	0.4	1.9	0.3	0.4	0.0	0.0	0.0	0.0
91	WASH	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.3	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0
92	WASH	0.7	0.1	0.0	0.1	0.1	0.0	28.3	5.7	4.7	2.7	3.4	0.6	0.1	0.1	0.1	0.1
93	WASH	0.2	0.0	0.0	0.0	0.0	0.0	8.4	1.7	1.4	0.8	1.0	0.2	0.0	0.0	0.0	0.0
94	WASH	4.7	0.7	0.2	0.4	0.3	0.1	174.5	35.1	28.9	7.1	20.9	1.5	0.1	0.1	0.1	0.1
95	WASH	3.4	0.5	0.1	0.3	0.3	0.1	131.5	26.5	21.8	7.7	15.7	1.6	0.1	0.1	0.1	0.1
96	WASH	5.9	0.9	0.2	0.5	0.4	0.2	221.7	44.6	36.7	89.3	26.5	19.2	0.2	0.2	0.2	0.2
97	WASH	13.6	2.1	0.5	1.0	1.1	0.4	542.4	109.1	89.9	36.5	64.9	7.9	0.2	0.2	0.2	0.2
98	WASH	6.7	1.0	0.2	0.5	0.5	0.2	256.4	51.6	42.5	3.8	30.7	0.8	0.1	0.1	0.1	0.1
99	WASH	18.5	2.7	0.6	1.4	1.3	0.5	673.6	135.5	111.6	0.1	80.6	0.0	0.0	0.0	0.0	0.0
100	WASH	15.9	1.8	0.4	1.2	0.9	0.3	466.0	93.7	77.2	0.1	55.8	0.0	0.1	0.1	0.1	0.1
101	WASH	10.2	1.5	0.4	0.8	0.7	0.3	372.0	74.8	61.6	3.0	44.5	0.6	0.1	0.1	0.1	0.1
102	WASH	12.5	1.8	0.4	1.0	0.9	0.3	448.0	90.1	74.2	41.1	53.6	8.8	0.2	0.2	0.2	0.2
103	WASH	8.3	1.1	0.3	0.6	0.5	0.2	270.3	54.4	44.8	23.0	32.4	4.9	0.2	0.2	0.2	0.2
104	WASH	8.5	1.3	0.3	0.7	0.7	0.2	329.5	66.3	54.6	3.8	39.4	0.8	0.1	0.1	0.1	0.1
105	WASH	9.1	1.2	0.3	0.7	0.6	0.2	305.8	61.5	50.7	0.3	36.6	0.1	0.1	0.1	0.1	0.1
106	WASH	43.8	5.0	1.2	3.4	2.5	0.9	1254.5	252.4	207.9	0.1	150.2	0.0	0.1	0.1	0.1	0.1
107	WASH	29.7	4.9	1.2	2.3	2.4	0.9	1237.8	249.0	205.1	0.1	148.2	0.0	0.1	0.1	0.1	0.1
108	WASH	5.1	0.6	0.2	0.4	0.3	0.1	160.7	32.3	26.6	0.5	19.2	0.1	0.1	0.1	0.1	0.1
109	WASH	5.7	0.8	0.2	0.4	0.4	0.2	213.3	42.9	35.3	5.8	25.5	1.2	0.1	0.1	0.1	0.1
110	WASH	9.3	1.1	0.3	0.7	0.5	0.2	272.7	54.9	45.2	0.3	32.6	0.1	0.1	0.1	0.1	0.1
111	WASH	7.4	0.9	0.2	0.6	0.5	0.2	231.7	46.6	38.4	0.3	27.7	0.1	0.1	0.1	0.1	0.1
112	WASH	13.1	1.6	0.4	1.0	0.8	0.3	404.7	81.4	67.1	0.2	48.4	0.0	0.1	0.1	0.1	0.1
113	WASH	1.7	0.2	0.1	0.1	0.1	0.0	60.6	12.2	10.0	1.3	7.3	0.3	0.1	0.1	0.1	0.1
114	WASH	2.8	0.4	0.1	0.2	0.2	0.1	102.9	20.7	17.0	142.6	12.3	30.7	0.2	0.2	0.2	0.2
115	WASH	11.6	1.7	0.4	0.9	0.9	0.3	435.3	87.6	72.1	40.9	52.1	8.8	0.2	0.2	0.2	0.2
116	WASH	12.8	1.9	0.5	1.0	1.0	0.4	468.4	98.3	80.9	40.5	58.5	4.1	0.2	0.2	0.2	0.2
117	WASH	28.5	4.1	1.0	2.2	2.0	0.8	1027.2	206.7	170.2	19.3	123.0	4.1	0.2	0.2	0.2	0.2
118	WASH	17.3	2.5	0.6	1.3	1.2	0.5	623.6	125.5	103.3	31.8	74.7	6.8	0.2	0.2	0.2	0.2
119	WASH	18.3	2.5	0.6	1.4	1.3	0.5	636.8	128.1	105.5	491.9	76.2	105.9	0.4	0.4	0.4	0.4
120	WASH	5.6	0.7	0.2	0.4	0.3	0.1	175.7	35.3	29.1	61.1	21.0	13.2	0.2	0.2	0.2	0.2
121	WASH	0.3	0.0	0.0	0.0	0.0	0.0	8.4	1.7	1.4	1.4	1.0	0.3	0.0	0.0	0.0	0.0
122	WASH	13.2	1.8	0.4	1.0	0.9	0.3	449.7	90.5	74.5	30.7	53.6	6.6	0.2	0.2	0.2	0.2

FIGURE 27. EXAMPLE OF CAASE5 OUTPUT TABLE 3, ALLOCATED FUELS

SOURCE NUMBER	COUNTY	DIRT RDS THAVELED STRIPS 10E341 LTO CYC	DIRT AIR	CONSTR. ACRES 10E3ACH	VISC. WIND EROSION	LAND TILLING	FOREST WILD FIRES ACR BURN	QUANT. ACR T/ACR	MANAGED BURNING QUANT ACP T/ACR	AGRICULTURAL FIELD BURNING QUANT ACP T/ACR	FROST CONTROL ORCH. BURY.	DAYS FIRED DY/YR	STRUC. FIRES #/YR
78	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
79	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
80	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7
81	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.1
82	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3
83	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7
84	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.4
85	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
86	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
87	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
88	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
89	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4
90	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
91	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
92	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
93	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
94	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3
95	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7
96	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9
97	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0
98	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3
99	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7
100	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0
101	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8
102	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8
103	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5
104	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3
105	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.2
106	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0
107	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1
108	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5
109	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
110	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.2
111	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
112	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
113	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6
114	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6
115	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
116	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.3
117	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.1
118	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.2
119	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3
120	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
121	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8
122	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8

FIGURE 29. EXAMPLE OF CAASES OUTPUT TABLE 5, ALLOCATED FUELS

(PARTICULATE)
(TONS PER YEAR)

SOURCE NUMBER	REGION	POLIT JURIS	COUNTY	COORDINATES X(KM) Y(KM)	(SQ.KM)	***** ANTH.	BITUM.	DIST.OIL	RES.OIL	NAT.GAS	***** WOOD
78	179		WASH	421.0 4335.0	12.30	0.0	0.1	0.0	0.0	0.1	0.0
79	179		WASH	437.0 4335.0	1.16	0.0	0.0	0.0	0.0	0.0	0.0
80	179		WASH	437.0 4343.0	35.39	0.0	0.8	0.2	0.0	0.3	0.1
81	179		WASH	445.0 4347.0	10.65	0.1	2.4	0.5	0.0	1.0	0.4
82	179		WASH	449.0 4347.0	2.49	0.0	0.6	0.1	0.0	0.3	0.1
83	179		WASH	421.0 4351.0	147.29	0.1	1.0	0.2	0.0	0.4	0.1
84	179		WASH	437.0 4351.0	64.00	0.1	1.2	0.2	0.0	0.5	0.2
85	179		WASH	445.0 4351.0	16.00	0.0	0.3	0.1	0.0	0.1	0.0
86	179		WASH	449.0 4351.0	3.74	0.0	0.0	0.0	0.0	0.0	0.0
87	179		WASH	453.0 4351.0	1.98	0.0	0.0	0.0	0.0	0.0	0.0
88	179		WASH	461.0 4351.0	4.95	0.0	0.4	0.1	0.0	0.2	0.1
89	179		WASH	469.0 4351.0	4.30	0.0	0.2	0.0	0.0	0.1	0.0
90	179		WASH	485.0 4351.0	1.00	0.0	0.0	0.0	0.0	0.1	0.0
91	179		WASH	451.0 4352.0	0.18	0.0	0.0	0.0	0.0	0.0	0.0
92	179		WASH	449.0 4353.0	4.00	0.0	0.0	0.0	0.0	0.0	0.0
93	179		WASH	451.0 4353.0	1.19	0.0	0.0	0.0	0.0	0.0	0.0
94	179		WASH	445.0 4355.0	16.00	0.0	0.3	0.0	0.0	0.0	0.0
95	179		WASH	449.0 4355.0	14.44	0.0	0.2	0.0	0.0	0.1	0.0
96	179		WASH	437.0 4359.0	64.00	0.0	0.4	0.1	0.0	0.2	0.1
97	179		WASH	445.0 4359.0	64.00	0.0	0.9	0.2	0.0	0.4	0.1
98	179		WASH	453.0 4359.0	14.18	0.0	0.4	0.1	0.0	0.2	0.1
99	179		WASH	457.0 4359.0	3.04	0.1	1.2	0.2	0.0	0.5	0.2
100	179		WASH	461.0 4359.0	3.75	0.1	1.0	0.2	0.0	0.4	0.2
101	179		WASH	465.0 4359.0	15.15	0.0	0.7	0.1	0.0	0.3	0.1
102	179		WASH	469.0 4359.0	61.71	0.0	0.8	0.2	0.0	0.3	0.1
103	179		WASH	477.0 4359.0	35.86	0.0	0.5	0.1	0.0	0.2	0.1
104	179		WASH	453.0 4363.0	16.00	0.0	0.6	0.1	0.0	0.2	0.1
105	179		WASH	457.0 4363.0	4.00	0.0	0.6	0.1	0.0	0.2	0.1
106	179		WASH	459.0 4363.0	3.95	0.2	2.9	0.6	0.0	1.2	0.4
107	179		WASH	461.0 4363.0	3.88	0.1	2.0	0.4	0.0	0.8	0.3
108	179		WASH	463.0 4363.0	4.00	0.0	0.3	0.1	0.0	0.1	0.1
109	179		WASH	465.0 4363.0	16.00	0.0	0.4	0.1	0.0	0.2	0.1
110	179		WASH	457.0 4365.0	4.00	0.0	0.6	0.1	0.0	0.2	0.1
111	179		WASH	459.0 4365.0	4.00	0.0	0.5	0.1	0.0	0.2	0.1
112	179		WASH	461.0 4365.0	4.00	0.0	0.9	0.2	0.0	0.4	0.1
113	179		WASH	463.0 4365.0	4.00	0.0	0.1	0.0	0.0	0.0	0.0
114	179		WASH	421.0 4367.0	55.10	0.0	0.2	0.0	0.0	0.1	0.0
115	179		WASH	437.0 4367.0	60.69	0.0	0.8	0.1	0.0	0.3	0.1
116	179		WASH	445.0 4367.0	64.00	0.0	0.8	0.2	0.0	0.3	0.1
117	179		WASH	453.0 4367.0	64.00	0.1	1.9	0.4	0.0	0.6	0.3
118	179		WASH	461.0 4367.0	64.00	0.1	1.1	0.2	0.0	0.5	0.2
119	179		WASH	469.0 4367.0	254.55	0.1	1.2	0.2	0.0	0.5	0.2
120	179		WASH	485.0 4367.0	47.13	0.0	0.4	0.1	0.0	0.1	0.1
121	179		WASH	493.0 4367.0	1.53	0.0	0.0	0.0	0.0	0.0	0.0
122	179		WASH	437.0 4375.0	53.42	0.0	0.9	0.2	0.0	0.4	0.1

FIGURE 30. EXAMPLE OF CAASE5 OUTPUT TABLE 1, ALLOCATED EMISSIONS, PARTICULATES

(PARTICULATE)
(TONS PER YEAR)

SOURCE NUMBER	COUNTY	***** AIRCRAFT ***** MILIT. CIVIL COM'L.	***** VESSELS ***** BITUM. DE. OIL RES.OIL GAS	*** EVAPORATION *** SOL.PUR. GAS.MKTD.	***** MEASURED VEHICLE MILES ***** LTD.ACC. RUR.RDS. SUB.RDS. UR8.RDS.
78	WASH	0.0	0.0	0.0	0.0
79	WASH	0.0	0.0	0.0	0.0
80	WASH	0.0	0.0	0.0	0.0
81	WASH	0.0	0.0	0.0	0.0
82	WASH	0.0	0.0	0.0	0.0
83	WASH	0.0	0.0	0.0	0.0
84	WASH	0.0	0.0	0.0	0.0
85	WASH	0.0	0.0	0.0	0.0
86	WASH	0.0	0.0	0.0	0.0
87	WASH	0.0	0.0	0.0	0.0
88	WASH	0.0	0.0	0.0	0.0
89	WASH	0.0	0.0	0.0	0.0
90	WASH	0.0	0.0	0.0	0.0
91	WASH	0.0	0.0	0.0	0.0
92	WASH	0.0	0.0	0.0	0.0
93	WASH	0.0	0.0	0.0	0.0
94	WASH	0.0	0.0	0.0	0.0
95	WASH	0.0	0.0	0.0	0.0
96	WASH	0.0	0.0	0.0	0.0
97	WASH	0.0	0.0	0.0	0.0
98	WASH	0.0	0.0	0.0	0.0
99	WASH	0.0	0.0	0.0	0.0
100	WASH	0.0	0.0	0.0	0.0
101	WASH	0.0	0.0	0.0	0.0
102	WASH	0.0	0.0	0.0	0.0
103	WASH	0.0	0.0	0.0	0.0
104	WASH	0.0	0.0	0.0	0.0
105	WASH	0.0	0.0	0.0	0.0
106	WASH	0.0	0.0	0.0	0.0
107	WASH	0.0	0.0	0.0	0.0
108	WASH	0.0	0.0	0.0	0.0
109	WASH	0.0	0.0	0.0	0.0
110	WASH	0.0	0.0	0.0	0.0
111	WASH	0.0	0.0	0.0	0.0
112	WASH	0.0	0.0	0.0	0.0
113	WASH	0.0	0.0	0.0	0.0
114	WASH	0.0	0.0	0.0	0.0
115	WASH	0.0	0.0	0.0	0.0
116	WASH	0.0	0.0	0.0	0.0
117	WASH	0.0	0.0	0.0	0.0
118	WASH	0.0	0.0	0.0	0.0
119	WASH	0.0	0.0	0.0	0.0
120	WASH	0.0	0.0	0.0	0.0
121	WASH	0.0	0.0	0.0	0.0
122	WASH	0.0	0.0	0.0	0.0

FIGURE 33. EXAMPLE OF CAUSES OUTPUT TABLE 4, ALLOCATED EMISSIONS, PARTICULATES

WASHINGTON COUNTY, OHIO (PARKERSBURG-MARIETTA AOCR - NEDS 1972) TEST 1/78) APPORTIONED EMISSIONS, TABLE 5, PAGE 1

(PARTICULATE)
(TONS PER YEAR)

SOURCE NUMBER	COUNTY	DIRT ROS TRAVELED STRIPS	DIRT AIR	CONSTR. ACRES	MISC. WIND EROSION	LAND TILLING	FOREST WILD FIRES ACR BURN QUANT.	MANAGED BURNING ACR BURN QUANT.	AGRICULTURAL FIELD BURNING ACR BURN QUANT.	FROST CONTROL ORCH. BURN.	DAYS FIRED	STRUC. FIRES
78	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
79	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
81	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
82	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
83	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
84	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
85	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
86	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
87	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
88	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
89	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
90	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
91	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
92	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
93	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
94	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
95	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
96	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
97	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
98	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
99	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
100	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
101	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
102	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
103	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
104	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
105	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
106	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
107	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
108	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
109	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
110	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
111	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
112	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
113	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
114	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
115	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
116	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
117	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
118	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
119	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
120	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
121	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
122	WASH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3

FIGURE 34. EXAMPLE OF CAASE5 OUTPUT TABLE 5, ALLOCATED EMISSIONS, PARTICULATES

WASHINGTON COUNTY, OHIO (PARKERSBURG-MARIETTA AQCR - NEDS 1972) TEST 1/78)

TOTALS BY SOURCE CATEGORY FOR POLLUTANT SP (TONS/YR)									
1.800	33.500	6.400	0.0	13.700	5.000	0.0	366.049	28.725	0.0
1.650	0.0	0.0	2875.183	0.0	3.525	0.0	2.400	0.0	0.0
81.440	28.000	6.800	31.200	28.000	10.400	0.0	0.0	0.0	9.346
0.0	62.604	0.875	0.0	1.229	0.0	0.0	53.160	0.0	0.0
0.0	0.0	0.0	133.494	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	12.366				

FOR POLLUTANT SP TOTAL EMISSIONS= 3796.844

TOTALS BY SOURCE CATEGORY FOR POLLUTANT SO2 (TONS/YR)									
0.0	280.060	9.216	0.0	0.822	0.300	0.0	573.496	27.576	0.0
0.099	0.0	0.0	2009.743	0.0	3.572	0.0	0.144	0.0	0.0
1.272	8.750	2.125	1.950	1.750	0.650	0.0	0.0	0.0	4.892
0.0	56.024	1.995	0.0	0.244	0.0	0.0	66.450	0.0	0.189
0.0	0.0	0.0	51.097	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.023				

FOR POLLUTANT SO2 TOTAL EMISSIONS= 3102.436

TOTALS BY SOURCE CATEGORY FOR POLLUTANT NOX (TONS/YR)									
0.540	5.025	7.680	0.0	109.600	2.000	0.0	31.556	114.900	0.0
19.800	0.0	0.0	180.300	0.0	14.100	0.0	43.200	0.0	0.0
2.545	10.500	2.550	11.700	10.500	3.900	0.0	0.0	0.0	106.567
0.0	693.720	12.950	0.0	1.110	0.0	0.0	496.160	0.0	0.822
0.0	0.0	0.0	1317.095	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.076				

FOR POLLUTANT NOX TOTAL EMISSIONS= 3199.894

TOTALS BY SOURCE CATEGORY FOR POLLUTANT HC (TONS/YR)									
0.450	33.500	1.920	0.0	10.960	4.000	0.0	6.860	5.745	0.0
1.320	0.0	0.0	12.020	0.0	0.705	0.0	0.720	0.0	0.0
229.050	17.500	4.250	58.500	52.500	19.500	0.0	0.0	0.0	300.484
0.0	75.952	3.290	0.0	5.443	0.0	0.0	130.242	0.0	27.930
309.000	297.000	0.0	1457.260	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	3.206				

FOR POLLUTANT HC TOTAL EMISSIONS= 3069.306

TOTALS BY SOURCE CATEGORY FOR POLLUTANT CO (TONS/YR)									
16.200	150.750	3.200	0.0	27.400	4.000	0.0	24.696	7.660	0.0
3.500	0.0	0.0	24.040	0.0	0.940	0.0	4.080	0.0	0.0
687.150	40.250	9.775	165.750	148.750	55.250	0.0	0.0	0.0	3406.650
0.0	195.520	4.550	0.0	31.104	0.0	0.0	173.656	0.0	88.800
0.0	0.0	0.0	7935.555	0.0	10759.125	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	27.938				

FOR POLLUTANT CO TOTAL EMISSIONS= 23996.070

FOOTNOTE: CATEGORIES BY ROW IN SAME ORDER AS AREA SOURCE NEDS INPUT FORM AND CAASES OUTPUT TABLES

FIGURE 35. EXAMPLE PRINTOUT OF COUNTY TOTAL EMISSIONS FOR ALL SOURCE CATEGORY AND POLLUTANT COMBINATIONS, CAASES

IPP INPUT CARD IMAGES

WASHINGTON COUNTY, OHIO (PARKERSBURG-MARIETTA AOCR - NEDS 1972) TEST 1/78)

1799999	780421043350	123	33	0.038	0.046	0.059	0.047	0.329	39	7100	A
1799999	790437043550	12	33	0.008	0.009	0.009	0.006	0.039	39	7100	A
1799999	800437043530	354	33	0.205	0.248	0.117	0.122	1.092	39	7100	A
1799999	810445043470	106	33	0.599	0.725	0.136	0.224	2.501	39	7100	A
1799999	820449043470	25	33	0.153	0.184	0.039	0.058	0.637	39	7100	A
1799999	830421043510	1473	33	0.278	0.355	0.787	0.692	4.689	39	7100	A
1799999	840437043510	640	33	0.302	0.367	0.202	0.208	1.791	39	7100	A
1799999	85045043510	160	33	0.075	0.091	0.062	0.055	0.449	39	7100	A
1799999	860449043510	37	33	0.014	0.016	0.021	0.015	0.102	39	7100	A
1799999	870453043510	20	33	0.011	0.013	0.013	0.008	0.057	39	7100	A
1799999	880461043510	49	33	0.106	0.126	0.034	0.043	0.449	39	7100	A
1799999	890469043510	43	33	0.049	0.059	0.023	0.023	0.219	39	7100	A
1799999	900485043510	10	33	0.002	0.003	0.012	0.008	0.042	39	7100	A
1799999	910451043520	2	33	0.001	0.001	0.003	0.001	0.006	39	7100	A
1799999	920449043530	40	33	0.015	0.017	0.023	0.016	0.108	39	7100	A
1799999	930451043530	12	33	0.005	0.005	0.009	0.006	0.034	39	7100	A
1799999	940445043550	160	33	0.083	0.100	0.061	0.056	0.467	39	7100	A
1799999	950449043550	144	33	0.063	0.076	0.058	0.050	0.396	39	7100	A
1799999	960437043590	640	33	0.121	0.154	0.360	0.307	2.057	39	7100	A
1799999	970445043590	640	33	0.254	0.311	0.212	0.206	1.696	39	7100	A
1799999	980453043590	142	33	0.118	0.143	0.056	0.059	0.558	39	7100	A
1799999	990457043590	30	33	0.304	0.369	0.069	0.113	1.268	39	7100	A
1799999	1000461043590	38	33	0.216	0.258	0.054	0.085	0.899	39	7100	A
1799999	1010465043590	151	33	0.171	0.206	0.064	0.076	0.763	39	7100	A
1799999	1020469043590	617	33	0.215	0.263	0.219	0.206	1.610	39	7100	A
1799999	1030477043590	359	33	0.131	0.159	0.134	0.122	0.946	39	7100	A
1799999	1040453043630	160	33	0.151	0.183	0.063	0.071	0.694	39	7100	A
1799999	1050457043630	40	33	0.140	0.169	0.039	0.055	0.588	39	7100	A
1799999	1060459043630	39	33	0.581	0.694	0.128	0.225	2.410	39	7100	A
1799999	1070461043630	39	33	0.551	0.673	0.116	0.198	2.301	39	7100	A
1799999	1080463043630	40	33	0.075	0.090	0.027	0.032	0.320	39	7100	A
1799999	1090465043630	160	33	0.100	0.120	0.060	0.058	0.516	39	7100	A
1799999	1100457043650	40	33	0.127	0.152	0.037	0.052	0.532	39	7100	A
1799999	1110459043650	40	33	0.107	0.129	0.033	0.044	0.452	39	7100	A
1799999	1120461043650	40	33	0.187	0.224	0.049	0.074	0.779	39	7100	A
1799999	1130463043650	40	33	0.029	0.035	0.021	0.017	0.143	39	7100	A
1799999	1140421043670	551	33	0.077	0.107	0.524	0.440	2.798	39	7100	A
1799999	1150437043670	607	33	0.208	0.255	0.217	0.202	1.579	39	7100	A
1799999	1160445043670	640	33	0.232	0.284	0.221	0.210	1.671	39	7100	A
1799999	1170453043670	640	33	0.472	0.572	0.198	0.238	2.301	39	7100	A
1799999	1180461043670	640	33	0.292	0.355	0.204	0.208	1.770	39	7100	A
1799999	1190469043670	525	33	0.386	0.517	1.778	1.550	10.158	39	7100	A
1799999	1200485043670	471	33	0.096	0.120	0.257	0.218	1.462	39	7100	A
1799999	1210493043670	15	33	0.005	0.006	0.012	0.008	0.044	39	7100	A
1799999	1220437043750	534	33	0.214	0.260	0.182	0.176	1.426	39	7100	A
1799999	1230445043750	640	33	0.238	0.284	0.221	0.213	1.686	39	7100	A
1799999	1240453043750	640	33	0.188	0.230	0.251	0.228	1.688	39	7100	A
1799999	1250461043750	640	33	0.139	0.173	0.317	0.275	1.884	39	7100	A
1799999	1260465043750	600	33	0.173	0.212	0.240	0.216	1.588	39	7100	A

FIGURE 36. EXAMPLE PRINTOUT OF DISPERSION MODEL INPUT CARD IMAGES, CAASE5, IPP MODEL

TABLE 16. OUTPUT TAPE RECORD LAYOUT FOR CAASE5*

OUTPUT FROM OUTPT1 SUBROUTINE (ALLOCATED FUELS)

(HEADER RECORD)

<u>Record Position</u>	<u>Format</u>	<u>Variable Name</u>
1	1X	CARRIAGE CONTROL (FILLER)
2 - 5	A4	IREGN
6 - 18	E13.5	STATE
19 - 28	I10	KOUNTY
29 - 38	I10	NAREAS
39 - 48	I10	IPUT
49 - 61	E13.5	TONSFW
62 - 74	E13.5	TONSMB
75 - 87	E13.5	TONSAF
88 - 100	E13.5	DAYSF

(FOR EACH GRID SQUARE (SUBSCRIPTED ON I) FOR THIS COUNTY, NAREAS IN NUMBER)

1 - 10	I10	ID(I)
11 - 23	E13.5	X(I)
24 - 36	E13.5	Y(I)
37 - 49	E13.5	AREA (I)
50 - 777	24E13.5/ 32E13.5	APFUEL (J,I) ⁺

OUTPUT FROM OUTPT2 SUBROUTINE (ALLOCATED EMISSIONS,
REPEATED FOR EACH OF THE POLLUTANTS).

(HEADER RECORD)

<u>Record Position</u>	<u>Format</u>	<u>Variable Name</u>
1	1X	CARRIAGE CONTROL (FILLER)
2 - 5	A4	IREGN
6 - 18	E13.5	STATE
19 - 28	I10	KOUNTY
29 - 38	I10	NAREAS
39 - 48	I10	IPUT
49 - 61	E13.5	XK
62 - 74	E13.5	DUM
75 - 87	E13.5	DUM
88 - 100	E13.5	DUM

(FOR EACH GRID SQUARE FOR THIS COUNTY, NAREAS IN NUMBER)

(SAME AS OUTPUT FROM OUTPT1 SUBROUTINE, EXCEPT THAT POSITIONS 50-777 CONTAIN
ALLOCATED EMISSIONS INSTEAD OF ALLOCATED FUELS.)

*Repeated for each county being processed.

⁺Source category subscripted on J.

TABLE 16. OUTPUT TAPE RECORD LAYOUT FOR CAASE5 (CONT.)

COUNTY TOTALS OF EMISSIONS FOR THIS POLLUTANT BY SOURCE CATEGORY

<u>Record Position</u>	<u>Format</u>	<u>Variable Name</u>
1 - 728	24E13.5/ 32E13.5	POLTOT (J,K)*

OUTPUT FROM OUTPT3 SUBROUTINE (DISPERSION MODEL INPUT CARD IMAGES)

(FOR EACH GRID SQUARE FOR THIS COUNTY, NAREAS IN NUMBER)

<u>Record Position</u>	<u>Format</u>	<u>Variable Name</u>
1 - 80	+	+

*Source category subscripted on J; pollutant subscripted on K.

+See Area Source Input Card format in user's manuals for the IPP, CDM, and AQDM dispersion models.

TABLE 17. DEFINITIONS OF CAASE5 OUTPUT TAPE VARIABLES

<u>Variable Name</u>	<u>Source</u>	<u>Definition</u>
	HEADER RECORD, OUTPT1 SUBROUTINE	
IREGN		Code number of selected study area
STATE		State number (FIPS) for this county
KOUNTY		County number (EPA) for this county
NAREAS		Number of grid squares for this county
IPUT		(Type of output) Code number for source of following records where: IPUT=1 OUTPT1 =2 OUTPT2 =3 OUTPT3
TONSF		Tons/acre burned, forest wildfires
TONSMB		Tons/acre burned, managed burning
TONSAF		Tons/acre burned, agriculture field burning
DAYSF		Frost control, orchard heaters, days/fired, days/year
	DETAIL RECORDS, OUTPT1 SUBROUTINE	
ID(I)		Grid square sequence number
X(I)		UTM Easting coordinate of the lower left hand corner of this grid square
Y(I)		UTM Northing coordinate of the lower left hand corner of this grid square
AREA(I)		Area of this grid square contained in this county
APFUEL(J,I)		Allocated fuels to this grid square-source category combination where J is source category number (fuels are in the same units as on the Area Source Input cards, see Figure 14)

TABLE 17. DEFINITIONS OF CAASE5 OUTPUT TAPE VARIABLES (CONT.)

<u>Variable Name</u>	<u>Source</u>	<u>Definition</u>
	HEADER RECORD*, OUTPT2 SUBROUTINE	
IREGN		As before
STATE		As before
KOUNTY		As before
NAREAS		As before
IPUT		As before
XK		Code number for which of the five pollutants follow, where: XK=1.0 (TSP) =2.0 (SO ₂) =3.0 (NO _x) =4.0 (HC) =5.0 (CO)
DUM		Filler to make header records compatible
	DETAIL RECORDS, OUTPT2 SUBROUTINE	
ID(I)		As before
X(I)		As before
Y(I)		As before
AREA(I)		As before
APFUEL(J,I)		As before, except array contains allocated emissions, pollutant determined by value of XK (see above)

*The header record, detail records, and county total records as a set are repeated in sequence for the 5 pollutants.

TABLE 17. DEFINITIONS OF CAASE5 OUTPUT TAPE VARIABLES (CONT.)

<u>Variable Name</u>	<u>Source</u>	<u>Definition</u>
	ADDITIONAL RECORDS, OUTPT2 SUBROUTINE (FOLLOWING EACH OF THE 5 POLLUTANTS)	
POLTOT (J,K)		County totals of emissions for this pollutant (K) for each source category (J)
	RECORDS OUTPUT FROM OUTPT3 SUBROUTINE	
(CARD IMAGES)		See dispersion model area source card formats in IPP, AQDM, or CDM User's Manuals

emissions. The header records define which subroutine has been called, identify the detailed records that follow, and define the number of them. OUTPT3 writes dispersion model card images.

6.4 Executive Control Language (ECL) and Deck Setup

An example of a deck setup configuration is illustrated in Figure 23. Using the Parkersburg-Marietta AQCR (#179) as an example study area, and Washington County, Ohio as an example county, the associated ECL and input data cards are illustrated in Figure 37. They describe the following:

- A. The CAASE5 program is in absolute form in cataloged file "A" on mass storage.
- B. The allocated fuels, emissions, and dispersion model card images will be written on tape as Fortran unit number 9. It will be labeled "AQCR179-EMISS". The volume and serial name is "KKKKKK".
- C. The apportioning factor file (output from CAASE4) is on tape as Fortran unit number 8. It is labeled "AQCR179-FACT". The volume and serial name is "JJJJJJ".
- D. Dispersion model input cards will be punched on the installation dependent standard card punch device.
- E. The emission factor cards, dispersion model selection card, county selector card, heading card, and NEDS Area Source fuels (throughput) cards are on the installation dependent standard card input device. IPP card images are requested. Washington County, Ohio is to be processed; it contains 58 grid squares. NEDS Area Source cards A1 through A5 for the Washington County, Ohio emissions inventory are to be used.

6.5 Warnings and Limitations

The CAASE5 main program is used to set dimensions and to pass them to the CAASE5 subroutine (which does most of the work) as "variable dimensions." The

```

@RUN 21RC5P,acct-code/user-id,project,time,pages/cards
@PASSWD password
@ASG,A A.
@ASG,T/W AQCR179-EMIS.,T,KKKKKK,0
@USE 9.,AQCR179-EMIS.
@ASG,T AQCR179-FACT.,T,JJJJJJ
@USE 8.,AQCR179-FACT.
@XQT A.CAASE5

```

(EMISSION FACTORS GO HERE, SEE FIGURE 22)

```

1
39      167      179      58      WASH 7100  36      PKB-MAR179
WASHINGTON COUNTY, OHIO (PARKERSBURG-MARIETTA AQCR - NEDS 1972) TEST 1/78
(NEDS AREA SOURCE CARDS A1-A5 FOR THIS COUNTY FOLLOW)
36710017972      440190  184  36  335 128  0 274  4 A1
36710017972  0 686 383  0 33  0  0 2404  0 47  0 48  0 0  A2
36710017972 509  70 17  39  35 13 20178 4038 1747 2121 376  74 A3
36710017972 0 432  0 0 443  0 60  309 270  0  0  0  0 A4
36710017972  0  0  0  0  0  0  0  0  0  0  0  0  0 229 A5
(BLANK CARD INDICATING NO MORE COUNTIES)

```

(IF MORE COUNTIES WERE TO BE PROCESSED, THEN THE REQUEST CARD, HEADER CARD,
AND NEDS A1-A5 CARD SETS WOULD FOLLOW FOR EACH COUNTY.)

```

@EOF
@FIN

```

FIGURE 37. ECL AND INPUT CARD EXAMPLE FOR CAASE5

variable NDIM is related to the number of grid squares; it must be as large as the largest number of grid squares in any county currently being processed. NDIM is passed to the CAASE5 subroutine as a variable dimension; CAASE5 passes NDIM to the subroutines it calls. The value assigned to the Fortran Dimension statements in the main program must be at least one larger than the value assigned to NDIM. (This is necessary because whenever the CAASE5 subroutine reads the grid square file, the end of the set of grid squares for one county is signaled by reading the first record of the next county; i.e., the county ID number changes. The end-of-file condition signals the end of the set of grid squares for the last county in the file.) Setting the dimensions higher than necessary would increase computer core storage requirements and, if significantly higher, could be reflected in higher computer facility charges.

In order to estimate the number of pages of printed output to expect from a CAASE5 run, keep in mind that 30 pages of tables are printed for every set of 45 grid squares in each county.

The EPA/NADB algorithm for calculating emissions from highway motor vehicles (in the NEDS system) is used by CAASE5. It calculates estimated vehicle miles traveled (VMT) by vehicle class and average miles per gallon using fuels marketed data. It then distributes these VMT values to road classes (urban, rural, suburban, and limited access) proportional to the measured vehicle miles reported on the NEDS Area Source Input form. However, if measured vehicle miles are missing for all road categories (numbers 43 through 46 in Table 12), then an alternative method, even though less desirable, must be used. In this case, the estimated degree of urbanization of the county can be used; this number is recorded in column number 77 of the NEDS Area Source Input card "A3" as "Pop.Code" (population code). Because the value represents urbanization only, the algorithm does not attempt to estimate

vehicle miles traveled on suburban or limited access roads. For example, an urbanization code of 3 would indicate 30% urbanization; the algorithm would assign 30% of the VMTs to the urban road class and 70% to the rural road class. If the urbanization code is also missing, the algorithm uses 90% urbanization to approximate the "worst case." Measured vehicle miles should be entered if available. If this is not possible, the user should estimate and enter a population code when it is missing.

Although all counties do not have to be processed during a computer run, those processed must be in the same order as the CAASE4 apportioning factor output file. Also, the NEDS Area Source cards must be in the same order, by counties, as the county selector cards; if the cards are out of order, an error message is printed and processing is terminated.

In some cases, a state or local agency may want to use emission factors that are different from the national ones. These present no problems because emission factors are read in by CAASE5 at program execution time. However, because CAASE5 reads emission factor data only once for a CAASE5 run, counties with local emission factors will have to be processed in separate runs if their emission factors are different from those of another county.

In the output tables, zero entries can be caused in several different ways. If no fuels were reported, or if an emission factor was not available, then obviously the output would be zero. If an overriding weighting factor was used, the user could selectively cause zeroes in some of the grid squares. If the amount allocated to a grid square is less than .05 units, rounding to the nearest .1 units for output printing would cause a zero to be printed. These small fractions are retained in the storage arrays in their original precision for any additional CAASE5 calculations.

If the percentages of ash and sulfur content are left blank on the area source input cards, their default value will be zero. Emissions from those source categories and pollutant combinations requiring ash or sulfur content will, therefore, be calculated as being zero.

7.0 SUBROUTINE DESCRIPTIONS

This section contains a description of all subroutines used in the CAASE system of programs. Flowcharts are included in the Appendixes with the appropriate CAASE calling program.

7.1 CED009 Subroutine

The CED009 subroutine is used by CAASE1 for the conversion of coordinates expressed in latitude and longitude to Universal Transverse Mercator (UTM) coordinates. The subroutine was obtained from the Mathematics and Computation Laboratory, National Resource Evaluation Center. It is described in NREC Technical Manual No. 187, dated July 1966. The subroutine will convert coordinates worldwide. CED009, as originally received, used five spheroid models which were: (1) International; (2) Clarke, 1866; (3) Clarke, 1880; (4) Everest; and (5) Bessel. Tables of coefficients necessary for the conversion equations are contained in a FORTRAN BLOCK DATA Subroutine. To minimize computer core storage requirements, the subroutine has been modified to deal only with the Clarke 1866 spheroid (the standard spheroid used in the United States for dispersion modeling). The BLOCK DATA Subroutine was modified to remove all tables of coefficients which were not related to the Clarke 1866 spheroid. The routine will convert geographic latitudes from 80° south of the Equator to 80° north of the Equator, with those south of the Equator being considered negative. The routine will convert any longitude from 180° west to 180° east of Greenwich, with those west of Greenwich being considered negative. As a result, the CAASE1 program sets the longitudes from the MED-X census data tapes to a negative value because all of the locations within the contiguous United States have west longitudes. Input variables to this subroutine are communicated through the subroutine call argument list except for the tables of coefficients. Those are communicated through FORTRAN labeled COMMON and are set in the BLOCK DATA Subroutine.

CED009 permits the entry of the geodetic location in radians or seconds with two different scaling factors for each. For consistency, CAASE1 calls CED009 with latitude and longitude in seconds scaled by 10^5 .

An error condition indicator is returned to the calling program. CAASE1 checks the error condition and prints an error message if necessary.

7.2 GTGR Subroutine

The GTGR (grid-to-grid) subroutine converts UTM location coordinates from one UTM zone to another. It is used by CAASE1 and CAASE2 when a study area straddles a UTM zone boundary.

It is necessary in order to construct a grid made up of contiguous squares of unequal size for a common origin to be established for the entire study area. The subroutine permits the grid-to-grid conversion from east to west, or from west to east; for example, in any two neighboring zones, one can express the coordinates in the eastern zone as points relative to the western zone or, conversely, can express the points in the western zone as coordinates relative to the eastern zone.

The subroutine was developed by EPA. The mathematical formulae to convert coordinates from one UTM zone to another are those contained in the Department of the Army Technical Manual TM-5-241-8, entitled "Universal Transverse Mercator Grid" (July 1958), Chapter 5, Section 31. Tables used in the GTGR subroutine are from the Department of the Army Technical Manual TM-5-241-2. Calculations are carried out in FORTRAN DOUBLE PRECISION arithmetic, and the tables for making the conversion are in a FORTRAN DEFINE FILE statement and reside on disk. To minimize computer storage requirements, only the necessary portion of the tables are read in to central core for each point to be converted.

The FORTRAN source code for a program to create the file of GTGR tables is contained in Appendix F. A listing of the card images containing the GTGR tables is also included in Appendix F.

The CAASE system will permit either UTM zone to be declared the "primary" zone, but the user is cautioned that when selecting the eastern zone it is possible to generate negative easting (east-west) UTM coordinates. Negative coordinates are not compatible with the input requirements of the IPP, AQDM, and CDM dispersion models. For the CAASE applications thus far, the western zone has been declared the "primary" zone with few exceptions. However, since a distortion error is introduced when converting from one zone to another, and is directly proportional to the distance the point is from outside of the "primary" zone, the user should be aware that if most of a study area lies in the eastern zone, less distortion will be introduced by making the eastern zone the "primary" zone. The introduction of negative easting coordinates must still be avoided.

GTGR is used by CAASE1 for the conversion of location coordinates for census data (from the MED-X file) from one zone to another. When necessary it is used in the same manner by CAASE2 for the conversion of location coordinates describing the county outline segments.

7.3 INBOUN Subroutine

Subroutine INBOUN (used by CAASE2) reads control cards and the county boundary data. It converts the county boundary coordinates from one UTM zone to another, if required, using subroutine GTGR in the same manner as conversion of census data coordinates in CAASE1. The converted coordinates are written to I/O device NOUT1 for later processing by the program. At the user's option, INBOUN also writes the county boundary data to I/O device NOUT3. INBOUN determines the coordinates of the extreme north, south, east, and west points of the study area boundary. It initializes the list of grid

squares by computing the number and locations of initial grid squares of maximum size needed to cover the entire study area.

7.4 TRACKR Subroutine

Subroutine TRACKR (used by CAASE2) determines which unit cells are interior, exterior, or boundary cells for a county. Since the techniques employed assume that the county boundary segments are oriented counterclockwise, the orientation of the segment coordinates is first tested and the segments are re-ordered if necessary.

Beginning with the first segment in the list, the points of intersection of the segments and the unit cells are computed. The unit cells intersected by the boundary are called the boundary cells. The county area contained in a boundary cell is computed. This value will be greater than zero and less than or equal to the unit cell area, in this case, 1 km^2 . The distinction between interior cells and boundary cells is made on the basis of area assigned to the cell with the interior cells having the value of the unit area. In the rare event the area of a boundary cell equals unit area, its value is replaced with .999 times the unit area to permit numerical distinction.

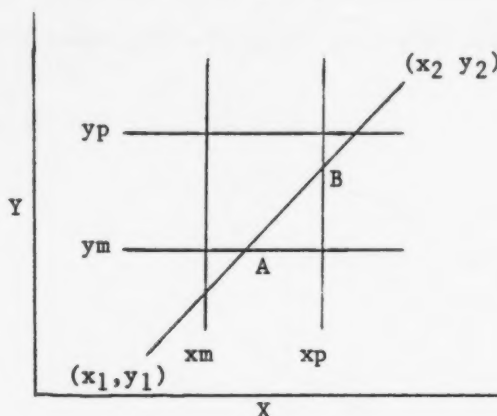
When a boundary segment departs from a unit cell, the next cell and its entry side must be found. The next cell must be one of the eight contiguous cells. As entry/departure from one boundary cell to the next occurs, the cell indices (i.e., the cell's row and column position within the grid cell array) change by ± 1 or zero. The change in indices is the key to which cells are interior to the current boundary cell. For example, if the row index changes by $+1$, the next cell is upward, or north of the current cell and the unit cells on the same row and to the left of the current boundary cell are interior cells. (In counterclockwise travel, the interior region is to the left of direction of travel.)

7.5 REORDR Subroutine

REORDR is called by Subroutine TRACKR (in CAASE2) to reorder the set of county outline coordinates in counterclockwise order if necessary. This is accomplished by reversing both the order of the coordinate pairs of each segment and the order of the segments.

7.6 SIDEIT Subroutine

SIDEIT is called by subroutine TRACKR (in CAASE2) to compute the point of intersection of a given county boundary segment with a given cell. The situation is illustrated in the following figure.



The unit cell is bounded by $x = x_m$, $x = x_p$, $y = y_m$ and $y = y_p$. The segment is defined by the coordinates of its end points and is directed from (x_1, y_1) to (x_2, y_2) . Assuming that point A (the intersection on side $y = y_m$) is known, the problem is to find coordinates of B, the point of intersection on $x = x_p$. B is called the departure (or exit) node.

The general "two-point" form of the equation of a straight line,

$$\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1},$$

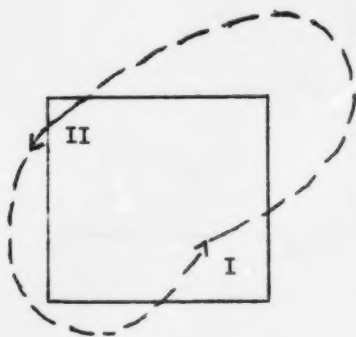
is used to find the points of intersection on the cell sides.

7.7 WRAPUP Subroutine

After a county boundary segment departs from a boundary cell, WRAPUP is called by subroutine TRACKR (in CAASE2) to finish computing the area of the interior county region. This region is enclosed by the county boundary segment and the sides of the boundary cell from the departure node to the entry node (see description of subroutine SIDEIT for definition of terms).

7.8 NETBAL Subroutine

NETBAL is called by subroutine TRACKR (in CAASE2) whenever the computed area contained in a boundary cell exceeds the unit area. The following figure shows the conditions which cause the computed contained area to exceed the unit area.



The area contained by the first transect, I, includes some area excluded by the second transect, II, namely the northwest corner of the cell. The second transect contains some area excluded by I, the southeast corner. Some of the area contained by I alone is also contained by II. The sum of the separately computed areas contained by I and II will exceed the total area of the cell by the amount of the overlapping common area. Thus, the sum of the areas must be reduced by the amount of the total area of the cell until the reduced sum is less than or equal to the total area of the cell.

Or in other words:

Contained Area = Summed Area (modulo unit area)

NETBAL performs the modulo function.

7.9 DECIDE Subroutine

DECIDE is called by subroutine TRACKR (in CAASE2) to determine the next boundary cell when a segment of the county boundary intersects the side of the current boundary cell and departs from it.

Figure 38 shows the eight combinations of Δx and Δy possible for a transect exiting side 1 of cell (i,j) .

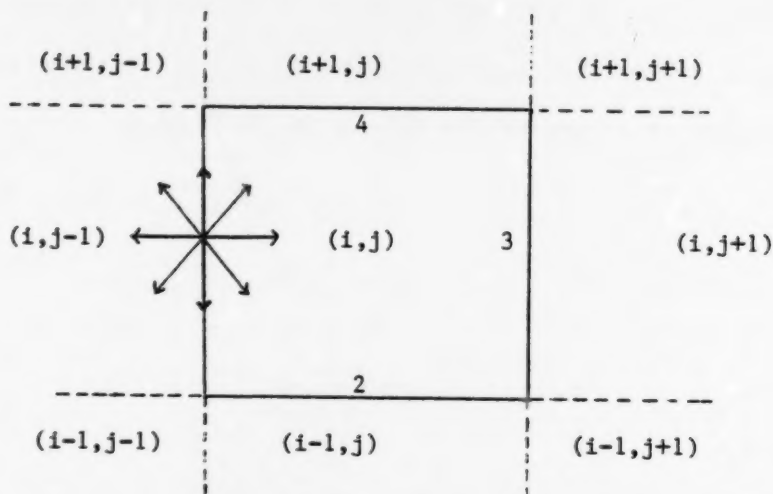


FIGURE 38. CELL (i,j) , PORTIONS OF THE ADJOINING CELLS, AND THE EIGHT COMBINATIONS OF $\Delta x, \Delta y$ FOR EXITING SIDE NUMBER 1.

These eight combinations are possible at each of the four sides and the four corners of cell (i,j) . Therefore, there are 64 possible combinations of exit side and direction of departure of the county boundary from any given boundary cell. The unique outcome (that is, the next boundary cell and its entry side) for any of the 64 combinations may be described by the value of an element in two of six 3×3 matrices. Elements in two of the matrices are the increments that must be added to the (i,j) indices of the current cell to

obtain the indices of the next cell. Elements in the other four matrices are the entry sides of the next cell. (Two of these latter four matrices are used for exits from a single side; the other two are used for exits from a corner.) The subscripts of the elements in the matrices are computed from tests on the combination of exit side and the signs of Δx and Δy of the exiting segment.

The matrices were derived by developing all 64 combinations explicitly, analyzing the results, and observing repeated patterns in the outcomes which led to groupings and simplifications. Only one example will be given to illustrate the development process.

Note in Figure 38 that the only possible increments to the indices of the current cell (i,j) are 0 for i and either 0 or -1 for j . Therefore, the two index increment tables that summarize the outcomes under the eight possible combinations of Δx and Δy for side 1 are as follows:

		Δy		
		<0	=0	>0
Δx	<0	0	0	0
	=0	0	=	0
	>0	0	0	0

		Δy		
		<0	=0	>0
Δx	<0	-1	-1	-1
	=0	0	=	-1
	>0	0	0	0

TABLE 18-a. i-INCREMENT,
EXIT SIDE 1.

TABLE 18-b. j-INCREMENT,
EXIT SIDE 1.

The symbol = means that both Δx and Δy are not simultaneously zero.

TABLE 18-b is rewritten in matrix form as

$$\begin{pmatrix} -1 & -1 & -1 \\ 0 & = & -1 \\ 0 & 0 & 0 \end{pmatrix}$$

MATRIX OF j-INCREMENTS,
EXIT SIDE 1.

The row and column subscripts of the elements in the matrix are determined by the algebraic signs of Δx and Δy . For example, $\Delta x < 0$ and $\Delta y > 0$ correspond to row/column subscripts (1,3). The value of element (1,3) is -1. Thus, when the exit side is number 1, and $\Delta x < 0$, $\Delta y > 0$, the j index of the next boundary cell is $j-1$ where j is the value of the current boundary cell.

After complete expansion of the eight combinations of Δx and Δy applied to all four sides and all four corners, two Increment Matrices are found to be adequate:

$$\begin{pmatrix} -1 & -1 & 0 \\ -1 & \infty & 0 \\ -1 & 0 & 0 \end{pmatrix} = I_1 \qquad \begin{pmatrix} -1 & -1 & -1 \\ 0 & \infty & -1 \\ 0 & 0 & 0 \end{pmatrix} = I_2$$

INCREMENT MATRIX 1

INCREMENT MATRIX 2

All other Increment Matrices may be expressed as functions of I_1 or I_2 or the zero matrix. Thus, for exit side 3 the j -increment matrix is

$$(j\text{-inc}_3) = \begin{pmatrix} 0 & 0 & 0 \\ 1 & \infty & 0 \\ 1 & 1 & 1 \end{pmatrix}$$

or

$$(j\text{-inc}_3) = I_2 + 1$$

where 1 is a 3 x 3 matrix of 1's,

The i -increment matrix for side 3 is

$$(i\text{-inc}_3) = 0.$$

The entry side table associated with an exit from side 1 is:

		Δy		
		<0	=0	>0
Δx	<0	3	3	3
	=0	1	=	3
	>0	1	1	1

TABLE 19. ENTRY SIDE OF CELL; EXIT SIDE 1.

The entries in Table 19 were deduced from Figure 38. For example, in exiting side 1 with $\Delta x < 0$ and $\Delta y > 0$, the entry into the next cell is through side number 3. If $\Delta x > 0$ and $\Delta y < 0$, the entry side is number 1.

Complete expansion and analysis of all 64 combinations result in four Entry Side Matrices. For single-side exit, i.e., not exiting via a corner, the following two Entry Side Matrices are sufficient:

$$E_3 = \begin{pmatrix} 3 & 3 & 3 \\ 1 & = & 3 \\ 1 & 1 & 1 \end{pmatrix} \quad E_4 = \begin{pmatrix} 4 & 4 & 2 \\ 4 & = & 2 \\ 4 & 2 & 2 \end{pmatrix}$$

The elements in E_3 are the entry sides when the exit side is 1 or 3. The elements in E_4 are the entry sides when the exit side is 2 or 4.

For corner exits, the Entry Side Matrices are:

$$E_1 = \begin{pmatrix} 4 & 4 & 2 \\ 1 & = & 2 \\ 1 & 1 & 1 \end{pmatrix} \quad E_2 = \begin{pmatrix} 3 & 3 & 3 \\ 4 & = & 3 \\ 4 & 2 & 2 \end{pmatrix}$$

The elements in E_1 are the entry sides when the exit is through the corners formed by sides 1 and 2 or sides 1 and 4. The elements in E_2 are the entry sides when the exit is through the corners formed by sides 2 and 3 or sides 3 and 4.

The use of the Index Increment and Entry Side Matrices is summarized as follows: determination of the next cell in tracking involves selection of a cell index increment matrix and an entry side matrix according to the side, or sides, of exit from the current cell. Determination of the appropriate element in the matrices selected depends on the algebraic signs of Δx and Δy . Table 20 summarizes the use of the Index Increment and Entry Side Matrices:

Single Exit Side				Corner Exit			
Exit Through Side No.	Use:			Exit Through Side	Use:		
	i-inc matrix	j-inc matrix	entry side matrix		i-inc matrix	j-inc matrix	entry side matrix
1	0	I_2	E_3	1 & 2	I_1	I_2	E_1
2	I_1	0	E_4	2 & 3	I_1	I_{2+1}	E_2
3	0	I_{2+1}	E_3	3 & 4	I_{1+1}	I_{2+1}	E_2
4	I_{1+1}	0	E_4	4 & 1	I_{1+1}	I_2	E_1

TABLE 20. SUMMARY OF CELL INDEX INCREMENT MATRICES AND ENTRY SIDE MATRICES TO BE USED UNDER CONDITIONS OF SINGLE SIDE EXIT OR CORNER EXIT FOR SPECIFIED SIDES OR CORNERS.

7.10 NTRIOR and FINAL Subroutines

NTRIOR and FINAL are called by subroutine TRACKR (in CAASE2) to determine the cells interior to the county boundary.

The determination of the interior and exterior cells comprises two phases. The first is the flagging, on a cell-by-cell basis as tracking proceeds, of interior/exterior cells on the same row and column of the current boundary cell. This phase will "catch" the exterior cells that occur as interior pockets contained by highly convoluted figures. The second phase, applied after the figure defined by the boundary is established, will determine those cells generally exterior to the envelope (of cells) of the figure. Subroutine NTRIOR accomplishes the first phase. Subroutine FINAL accomplishes the second phase.

FINAL returns the entire grid cell array flagged with values to indicate interior, exterior, or boundary cells. These values will be used in PROXPR to print the county map and in PROXML to construct the proximal map.

7.11 PROXPR Subroutine

PROXPR is used by CAASE2. It prints a map of a county showing exterior cells as blank characters, boundary cells as asterisks, and interior cells as the character I. (See Figure 8 in Section 3.3.)

7.12 INPOP Subroutine

INPOP (used by CAASE2) reads the edited MED-X census data tape created by CAASE1, computes the total county population and housing, and determines the indices of the control cells from the Census Enumeration District (ED) coordinates.

7.13 PROXML Subroutine

Subroutine PROXML (used by CAASE2) computes the proximal map of a county based on the edited MED-X census data tape. A proximal map is based on the so-called "nearest neighbor" method of interpolation. A control cell is a unit grid cell that contains centroid coordinates of one or more Census Enumeration Districts (ED's). An empty grid cell contains no ED centroids. For each empty cell, there is a control cell nearer to it than any other control cell with the occurrence of ties (equally distant control cells) being resolved by a random selection. This nearest control cell is the nearest neighbor of the empty cell. Conversely, associated with each control cell, there is a collection of empty grid cells having it as their nearest neighbor. For any control cell, the associated collection of empty grid cells represents an approximation of the region of the ED's whose centroids are in that control cell. The sum of the cell areas is taken as the approximate area of the original ED's. Population and housing densities are computed from this approximate area and the control cell's population and housing. These

densities are assumed to be uniformly distributed over the approximating area and are therefore assigned equally to each associated unit cell. Consequently, every grid cell in the county is assigned a population/housing count based on the population and housing of the ED's nearest it.

PROXML determines the nearest neighbors and computes the population and housing densities.

7.14 SEARCH and SETLGO Subroutines

SEARCH is called by subroutine PROXML (in CAASE2) to find the nearest neighbor control cell (see subroutine PROXML description) of each grid cell in a county. It employs a search technique that is based on the assumption that the most likely nearest neighbor control cell of the cell having row/column indices (i,j) is the nearest neighbor of the previous cell with indices (i, j-1). The distance from cell (i,j) to the nearest neighbor of cell (i, j-1) is used to place upper and lower limits on the indices of the rows and columns searched for a nearer neighbor to cell (i,j). Subroutine SETLGO is used in conjunction with SEARCH to determine the index of the non-empty row nearest each row of grid cells.

7.15 TIEBRK Subroutine

TIEBRK is called by subroutine SEARCH (in CAASE2) when the distances from a grid cell to two different control cells are equal. TIEBRK resolves the choice of which is nearer by calling a random number generator internal subroutine RANDU (copied from the IBM Scientific Subroutine package) to provide a uniformly distributed random number between 0 and 1. If the number is greater than 0.5, the return to SEARCH will cause one of the control cells to be chosen; otherwise, the other control cell is chosen.

7.16 GRIDIT Subroutine

GRIDIT (used by CAASE2) constructs a grid square system based on a given population density surface. GRIDIT will attempt to read user-provided grid square records from the card input stream to the end of file. A count is kept

on the number of cards read. If no user grid cards are provided, the count will be zero and GRIDIT will construct a grid. If cards are provided, the count will be non-zero and GRIDIT will not construct a grid.

7.17 ADJUST Subroutine

ADJUST (used by CAASE2) partitions boundary squares having only a small portion of their contained area within the outline of the total study area until the contained area is a greater percentage of the square's area. Any empty squares resulting from the partitioning will be deleted from the list of grid squares.

7.18 SQROFF Subroutine

SQROFF (used by CAASE2) determines which grid squares belong to which counties. If a square shares its area with a county, it is assigned that county's FIPS code number.

SQROFF reads in the population proximal map of a county and compares it to the entire list of grid squares. (The values stored in the cells making up the proximal map are population. There are two other proximal maps that contain housing and area values.) A zero value of population in a grid cell means the cell is not in the county. For a given grid square, if the sum of values of all cells within the square is zero, the grid square is totally outside the county. If the sum is not zero, the grid square and county share common area and the grid square is therefore assigned the county FIPS identification number. In addition, the summations of population, housing, and contained area in the grid cells shared by the grid square with the three proximal maps are assigned to the square.

A square may overlap more than one county. In this case, the square will receive multiple county assignments. Separate card image records of the grid square will be output for each county to which the square belongs with the records differing in the county code, fractional area contained, contained

population and contained housing. The side lengths and southwest corner coordinates of squares having multiple records are equal.

7.19 OUTPUT Subroutine

OUTPUT is used by CAASE2 to output the card images and print the grid square records.

7.20 PARTIT Subroutine

PARTIT is called in CAASE2 by subroutines GRIDIT and ADJUST to partition a specified grid square into four smaller squares of equal size by dividing its side length by two. The coordinates of the southwest corners of the new squares are one-half the side lengths from the origin of the original square. The list of grid squares is updated by adding the side lengths and coordinates of the new squares to the appropriate vector storage arrays. The total number of squares is increased by three. A test of the number of squares versus the maximum* permissible governs the return to the calling program. A test to prevent partitioning of squares to less than unit area is included.

7.21 DELETE Subroutine

DELETE is called in CAASE2 by subroutines GRIDIT and ADJUST to remove empty grid squares from the list of grid squares.

7.22 INTEGR Subroutine

INTEGR is called in CAASE2 by subroutines GRIDIT, ADJUST, and SQROFF to compute the integral of either population, housing, or area in a grid square specified by the calling program.

7.23 ASTORE and NSTORE Subroutines

The purpose of subroutines ASTORE and NSTORE (used by CAASE2) is to eliminate repetitive coding of FORTRAN IF - GO TO statements followed by non-computational equations. Their functioning is apparent from their simple

*1800 in applications thus far.

coding. The difference between them is that the arguments of ASTORE are floating point variables, and those of NSTORE are integers. NSTORE is an ENTRY in ASTORE. Other entries in ASTORE are subroutines YOFX and XOFY. ASTORE is called by subroutines TRACKR and WRAPUP, NSTORE by DECIDE and SIDEIT.

7.24 YOFX and XOFY Subroutines

YOFX AND XOFY are entries in subroutine ASTORE used by CAASE2. They are called by subroutine SIDEIT to compute the intersections of the county boundary segments with the grid cells.

The two point equation of a straight line is given by

$$\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$$

For specified (x_1, y_1) , (x_2, y_2) , and x , YOFX computes

$$y = (x - x_1) \frac{y_2 - y_1}{x_2 - x_1} + y_1$$

For specified (x_1, y_1) , (x_2, y_2) , and y , XOFY computes

$$x = (y - y_1) \frac{(x_2 - x_1)}{(y_2 - y_1)} + x_1$$

Both subroutines test for denominators less than the variable, "EPS" (a very small number specified in the main program) in absolute value; this is a test for zero divisor. If such should occur, the solution is set to a large value.

7.25 FAREA Subroutine

FAREA (used by CAASE2) computes the area A under the line segment in Figure 39 by the formula:

$$A = \frac{(y_2 + y_1)}{2} (x_2 - x_1).$$

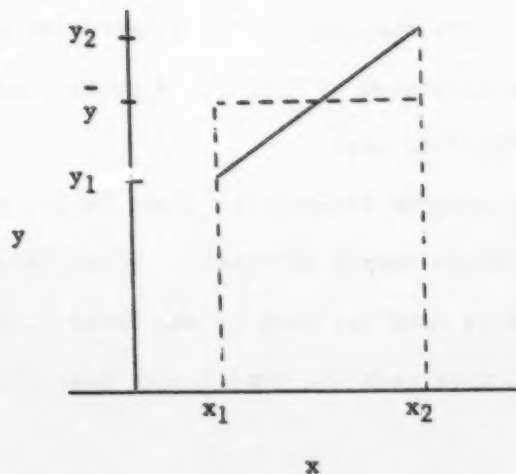


FIGURE 39. AREA UNDER A LINE SEGMENT.

7.26 SORT Subroutine

SORT is used by CAASE2 to sort the grid squares in ascending order by state, county, UTM Northing, and UTM Easting.

7.27 POPBOX Subroutine

POPBOX is used by CAASE3. It creates the plotter file for drawing a scaled map of the study area. The axes and tick-marks are drawn and labeled.

POPBOX also draws the grid square network. It is given the coordinates of the lower left-hand corner of each grid square and its side length. It

calculates the coordinates for the other three corners. Lines are then drawn through the five points (the lower-left hand corner being both the starting and ending point). A grid can be drawn to any scale, the only limitation being the physical size of the available plotter space. In the CAASE applications thus far, the scale 1:250,000 has been used. The scale factor is an input variable to the CAASE3 main program.

7.28 EDPLOT Subroutine

EDPLOT is used by CAASE3 to optionally plot the enumeration districts and psuedo-enumeration districts as processed by CAASE1. A control parameter read by CAASE3 determines whether EDPLOT is used.

As discussed in the CAASE1 program description (Section 2), there are three types of enumeration districts output by CAASE1. A unique mark from the CALCOMP plotter subroutine MARK is used for each of the three types of enumeration districts. Type 1 uses mark #1, type 2 uses mark #5, and type 3 uses mark #9.

7.29 COOUT Subroutine

COOUT is optionally used by CAASE3 to draw county outlines on the study area map. A control parameter read by CAASE3 determines whether COOUT is used.

7.30 READ1 Subroutine

READ1 is used by CAASE5 to read the fuels (throughput) totals for the county being processed. The format is the same as the first five cards on the NEDS Area Source Form [EPA (DUR) 219 3/72]. The routine also calculates the gasoline fuel use for light trucks using fractions of the reported fuels for light vehicles (gasoline) and heavy vehicles (gasoline). The algorithm currently used by the EPA National Air Data Branch (NADB) for the National Emissions Data System (NEDS) area sources is used.

The following calculations are used:

$$\begin{aligned} \text{Light Truck Fuel Total} &= .122 \times \text{Light Vehicle Fuel Total} \\ &+ .273 \times \text{Heavy Vehicle Fuel Total.} \end{aligned}$$

Light vehicle and heavy vehicle fuels are reduced accordingly, that is:

$$\begin{aligned} \text{Modified Light Vehicle Fuel Total} &= \text{Reported Light Vehicle} \\ &\text{Fuel Total} \times .878. \end{aligned}$$

$$\begin{aligned} \text{Modified Heavy Vehicle Fuel Total} &= \text{Reported Heavy Vehicle} \\ &\text{Fuel Total} \times .727. \end{aligned}$$

7.31 OUTPT1 Subroutine

OUTPT1 is used by CAASE5. It formats and prints a tabular listing of the allocated county fuels (throughput) totals for all area source categories identified on the NEDS Area Source Form [EPA (DUR) 219 3/72].

OUTPT1 also writes a formatted tape (see Tables 16 and 17 for a description of the record layout and contents).

7.32 OUTPT2 Subroutine

OUTPT2 is used by CAASE5. It formats and prints the allocated emissions for each source category identified on the NEDS Area Source Form [EPA (DUR) 219 3/72].

As a county is being processed by CAASE5, OUTPT2 is called five times, once for each pollutant (TSP, SO₂, NO_x, HC, and CO).

OUTPT2 also writes a formatted tape (see Tables 16 and 17 for a description of the record layout and contents).

With the exception of formatting and labeling, OUTPT2 is very similar to OUTPT1.

7.33 OUTPT3 Subroutine

This routine is called by the CAASE5 program and outputs allocated area source emissions as cards (or card images) for direct input to one of three

atmospheric dispersion models. The three models are the Implementation Planning Program (IPP), the Air Quality Display Model (AQDM), and the Climatological Dispersion Model (CDM). The selection of the format is controlled by an input variable.

As each county is processed, one emissions total is output for each grid square for each pollutant. That is, the calculated emissions for all area source categories allocated to a grid square are summed. Units conversions are made if necessary. A constant value of 10 meters or 33 feet is assigned as the stack height.

OUTPT3 also writes a formatted tape (see Tables 16 and 17 for a description of the record layout and contents).

8.0 OBJECTIVE APPORTIONING FACTORS AND SUBJECTIVE OVERRIDING WEIGHTING FACTORS

This section discusses the procedures for introducing user-provided overriding weighting factors for allocating fuels and emissions to the sub-county grid square network. The assignment of overriding weighting factors and their effect on the objective apportioning factors are discussed in detail in this section. The program input formats and descriptions are included in the discussion of the CAASE4 program in Section 5.

A basic concept in the development of the CAASE procedures was to use objective techniques, where possible, to select a grid. Also, objective methods were to be used, when possible, for allocating fuels (throughput) and emissions from county totals for each source category into each grid square. It was recognized that many of the source categories were amenable to apportioning as functions of the distribution of population and housing within counties. Ideally, objective methods could be used throughout the processing of area source data using computer processable data sources already available in computer compatible data bases. Certain categories of usable data are available for some counties while not always available for others; further, much of the data exist only in source document or tabular form, e.g., land use maps, traffic counts, airport operations activity, etc. Much effort would be necessary to assemble and incorporate these data into a computer processable data base for objective apportioning. Such an effort, practical or not, was beyond the scope of the CAASE project. It appeared, however, that area source emissions for most categories were amenable to distribution by objective techniques to the grid squares of a county.

For convenience, the fields of fuels (throughput) data on the NEDS Area Source Input Form [EPA (DUR) 219 3/72] have been sequentially numbered. Table 12 relates the assigned category number to its major and minor

classifications. (Category number 28, Gasoline Fuel, Light Truck is a derived number calculated by taking a portion of categories 27 and 29 fuels.)

The majority of the categories can be apportioned using functions of area, population, and housing. However, provisions are made in the CAASE4 program to override any or all source categories for each grid square if available information indicates that the objective factors used by CAASE4 will not yield acceptable results. To facilitate the use of any additional available data for apportioning, the apportioning factor program (CAASE4) logic has been written to optionally accept user-provided weighting factors for any area source category for any grid square. As discussed in more detail in later paragraphs, the "effective" apportioning factor is the product of the user-provided weighting factor multiplied times the assigned objective factor. The default user-provided weighting factor is 1.0.

An objective apportioning factor has been assigned to each area source emission category reported on the NEDS Area Source Form [EPA (DUR) 219 3/72]. Table 21 shows the objective apportioning factor assigned for each source category. Candidate objective apportioning factors available on the Bureau of the Census MED-X* tapes include population, housing counts, and an urban-rural classification. After the grid is established, each grid square's contained population, housing, area, and side length⁺ are available.

When available apportioning factors were being selected and assigned to the source categories, it was concluded that some categories were quite

*Master Enumeration District Listing (MEDList) extended to include geographic coordinates.

⁺If the contained area for a grid square is shared by two or more counties, an "effective side length" for each county is calculated by computing the square root of the contained area within that county.

TABLE 21. "NEW" AREA SOURCE EMISSIONS CATEGORY NUMBERS
AND THEIR OBJECTIVE APPORTIONING FACTOR

CATEGORY NUMBER	MAJOR CLASSIFICATION	MINOR CLASSIFICATION	OBJECTIVE APPORTIONING FACTOR*
1	RESIDENTIAL FUEL	ANTH. COAL	HOUSING UNITS
2	RESIDENTIAL FUEL	BITUM. COAL	HOUSING UNITS
3	RESIDENTIAL FUEL	DIST. OIL	HOUSING UNITS
4	RESIDENTIAL FUEL	RESID. OIL	HOUSING UNITS
5	RESIDENTIAL FUEL	NAT. GAS	HOUSING UNITS
6	RESIDENTIAL FUEL	WOOD	HOUSING UNITS
7	COMM'L & INSTTL FUEL	ANTH. COAL	POPULATION
8	COMM'L & INSTTL FUEL	BITUM. COAL	POPULATION
9	COMM'L & INSTTL FUEL	DIST. OIL	POPULATION
10	COMM'L & INSTTL FUEL	RESID. OIL	POPULATION
11	COMM'L & INSTTL FUEL	NAT. GAS	POPULATION
12	COMM'L & INSTTL FUEL	WOOD	POPULATION
13	INDUSTRIAL FUEL	ANTH. COAL	POPULATION
14	INDUSTRIAL FUEL	BITUM. COAL	POPULATION
15	INDUSTRIAL FUEL	COKE	POPULATION
16	INDUSTRIAL FUEL	DIST. OIL	POPULATION
17	INDUSTRIAL FUEL	RESID. OIL	POPULATION
18	INDUSTRIAL FUEL	NAT. GAS	POPULATION
19	INDUSTRIAL FUEL	WOOD	POPULATION
20	INDUSTRIAL FUEL	PROCESS GAS	POPULATION
21	ON-SITE INCINERATION	RESIDENTIAL	HOUSING UNITS
22	ON-SITE INCINERATION	INDUSTRIAL	POPULATION
23	ON-SITE INCINERATION	COMM'L & INSTTL	POPULATION
24	OPEN BURNING	RESIDENTIAL	HOUSING UNITS
25	OPEN BURNING	INDUSTRIAL	POPULATION
26	OPEN BURNING	COMM'L & INSTTL	POPULATION
27	GASOLINE FUEL	LIGHT VEHICLE	POPULATION
28	GASOLINE FUEL	LIGHT TRUCK	POPULATION
29	GASOLINE FUEL	HEAVY VEHICLE	POPULATION
30	GASOLINE FUEL	OFF HIGHWAY	1/POPULATION DENSITY
31	DIESEL FUEL	HEAVY VEHICLE	POPULATION
32	DIESEL FUEL	OFF HIGHWAY	1/POPULATION DENSITY
33	DIESEL FUEL	RAIL LOCOMOTIVE	GRID SQ. SIDE LENGTH
34	AIRCRAFT	MILITARY	AREA
35	AIRCRAFT	CIVIL	AREA
36	AIRCRAFT	COMMERCIAL	AREA
37	VESSELS	COAL	GRID SQ. SIDE LENGTH
38	VESSELS	DIESEL OIL	GRID SQ. SIDE LENGTH
39	VESSELS	RESID. OIL	GRID SQ. SIDE LENGTH
40	VESSELS	GASOLINE	GRID SQ. SIDE LENGTH
41	EVAPORATION	SOLVENT PURCHASED	POPULATION
42	EVAPORATION	GASOLINE MARKETING	POPULATION
43	MEASURED VEH MILES	LIMITED ACCESS RDS	1/POPULATION DENSITY
44	MEASURED VEH MILES	RURAL ROADS	1/POPULATION DENSITY
45	MEASURED VEH MILES	SUBURBAN RDS	POPULATION
46	MEASURED VEH MILES	URBAN ROADS	POPULATION
47	DIRT RDS TRAVELED	...	1/POPULATION DENSITY
48	DIRT AIRSTRIPS	...	1/POPULATION DENSITY
49	CONSTRUCT LAND AREA	...	AREA
50	MISC. WIND EROSION	...	1/POPULATION DENSITY
51	LAND TILLING	...	1/POPULATION DENSITY
52	FOREST WILDFIRES	AREA-ACRES	1/POPULATION DENSITY
53	MANAGED BURNING	AREA-ACRES	1/POPULATION DENSITY
54	AGRI. FIELD BURNING	AREA-ACRES	1/POPULATION DENSITY
55	FROST CONTROL	ORCHARD HEATERS	1/POPULATION DENSITY
56	STRUCTURE FIRES	NO. PER YEAR	POPULATION

*Each of the above apportioning factors is multiplied by a weighting factor initialized as 1.0 for all grid squares. These initial weighting factors can be overridden with input data if desired.

amenable to apportioning using objective factors whereas others are not. For example, the housing count in each grid square is a good choice for allocating residential heating source categories. However, source categories associated with aircraft operations affect only portions of a county and should be overridden in most cases.

Although the CAASE system permits overriding weighting factors to be assigned for any source category, they should be limited to those categories where acceptable objective data (in a computer processable form) are not available. To allocate emissions from airport operations over the entire county as a function of the area of each grid square (see Table 21) might introduce only a small error. However, it can easily be determined which grid squares in a county contain airports, or are affected by the airports. On the other hand, much time could be spent in preparing overriding weighting factors for railroad operations. To allow CAASE4 to use the objective factor (i.e., grid square side length) to assign apportioning factors to all grid squares in an urban county containing a large number of grid squares and heavy railroad activity (e.g., St. Clair County, Illinois) may yield comparable results. The percentage errors may be acceptable.

One suggested approach, before deciding to override a source category, is to run the CAASE4 program without overriding the objective apportioning factors for the category; then to run the CAASE5 program with those assigned apportioning factors. Two outputs from CAASE5 are the county totals of emissions by pollutant and a table of county totals by source category and pollutant (see Figure 35 in Section 6). Each source category's contribution to the county total area source emissions can be readily determined. For example, from data in Figure 35, Washington County, Ohio railroad activity (category 33) contributed .875 tons/year of TSP to the county total of 3796.8

tons/year and therefore represents only .023% of the total. NO_x for railroad activity is .405% of the Washington County total.

An important point to keep in mind when assigning overriding weighting factors is that the calculated apportioning factors are normalized in the CAASE5 program. That is, each apportioning factor is developed by dividing the weight assigned to the particular grid square (for a particular source category) by the sum of the weights assigned to all grid squares (for that category) in the county. The total fuels or emissions apportioned to the individual grid squares in the county will not be modified whether the total refers to housing counts, area, population, or a combination of these and/or other factors. For each source category, the apportioning factors represent each grid square's proportion of the county total. This apportioning factor is the numerator for the fraction of total fuels (or emissions) which will be apportioned to that particular grid square for that particular source category. To sum all of the fractions for a particular source category associated with each individual grid square within the county will yield unity.

As discussed earlier, the effective apportioning factor is calculated by multiplying an objective apportioning factor (see Table 21) by a weighting factor. The apportioning algorithm in CAASE4 assumes a weighting factor of 1.0. If the default weighting factor of 1.0 is used, the apportioning is totally controlled by the assigned objective apportioning factor, e.g., housing units. The following paragraphs discuss how to override the default 1.0 weighting factor. When a source category is to be overridden, a card is read by CAASE4 with the source category number and an initialization constant (generally 0.0 or 1.0). Cards are then read for each grid square that is to

be overridden with a different weighting factor than the initialized factor for that source category.

An example of source category weighting factors that generally should be overridden are those for airport operations (source categories 34, 35, and 36). If no airports are located within the county or if LTO (Landing-Take-Off) cycles are not included in the area source inventory, no airport weighting factor overriding action is necessary. For airport operations categories the initializing constants (read by CAASE4) should be zero because fewer grid squares will be allocated fuels and emissions than those that will not. These user-initialized zero weighting factor assignments mean that no aircraft landing-take-off cycles, or emissions associated with them, will be allocated to a grid square unless the user assigns a non-zero weighting factor to that grid square. For aircraft LTOs and associated emissions the assigned objective apportioning factor is area. A grid square which has a large area would therefore be allocated more LTOs and associated emissions than a grid square which has a smaller area (if the weighting factors are equal). If a grid square is affected by aircraft operations, the user can, for example, assign a 1.0 weighting factor. (This is done after initializing all grid squares to zero for the aircraft categories.) The CAASE4 program would then assign apportioning factors strictly as a function of area for only those grid squares affected; that is, a grid square of one square kilometer would be assigned an apportioning factor only one twenty-fifth ($1/25$ th) of the apportioning factor assigned to a five-by-five kilometer grid square representing 25 square kilometers. The user would normally want to assign higher weights to grid squares near an airport than to those farther away. To do this the user can, for example, assign an overriding weighting factor of 3.0 to the grid squares nearest an airport, 2.0 to grid squares farther away but still affected, and 1.0 to the furthestmost affected grid squares.

This would cause both the area of the affected grid squares and their proximity to the airport (and aircraft operations areas) to be determining factors in allocating LTOs and associated emissions within the county. The values 3.0, 2.0, and 1.0 were used for illustration. The user can assign any value on any scale. The procedure is more complex in a county containing more than one active airport. In this case, the user must keep in mind that the weighting factors apply to the county totals. If data are available for the relative operational activity at the two or more airports in the county, these data should be used in assigning overriding weighting factors.

Referring back to the example above, where proximity to the airport was also taken into consideration, and supposing the county had two airports, then let the above example be for Airport A. Let the second airport be called Airport B. If Airports A and B had equal operational activity, i.e., LTOs for a source category, then 3.0, 2.0, and 1.0 weighting factors could be assigned to grid squares affected by Airport B LTOs according to their proximity to Airport B in the same manner as was done with Airport A. The next degree of complexity for the two-airport example is encountered when their relative activities for a source category are not equal. To modify the above two-airport example, for illustration, suppose Airport B had twice the activity as Airport A (i.e., two-thirds of the LTOs were at Airport B and one-third at Airport A); then, the nearest grid square to Airport B could be assigned an overriding weighting factor of 6.0 whereas a 3.0 had been assigned to the nearest grid square for Airport A, etc. The overriding weighting factors assigned to other affected grid squares must reflect both the relative airport activity and each affected grid square's proximity to the airports.

The above examples for aircraft activity were given to illustrate the overriding of source categories where the area of the grid square is the

objective factor. Although conceptually similar, other source categories are treated differently.

Area source categories such as railway locomotives and waterborne vessels are also assigned apportioning factors as a function of the size of the grid square. However, in these cases the distance across a grid square and how the waterway or railroad tracks cross it are used in assigning an overriding weighting factor. The longest distance across a grid square is diagonally through opposite corners (e.g., northwest corner to southeast corner). This distance is directly proportional to the grid square side length. The ratio of the diagonal to the side length is a constant ($\sqrt{2}$ to 1). This constant would drop out in the CAASE5 apportioning factor normalizing calculations. The grid square side length is therefore used directly for these source categories. The discussion and examples following will be limited to the railway locomotive category, but the approach suggested is equally applicable to the waterborne vessel categories.

If the railway locomotive source category is to be assigned overriding weighting factors, then there are several things to consider when assigning an overriding factor to a grid square. To simplify the examples, no attempt is made to incorporate the number of trains passing across a grid square in a given time frame, nor is the average number of locomotive units per train considered. These data probably will seldom be directly available to the CAASE user. The number of pairs of tracks crossing the grid square is directly available from USGS (U.S. Geological Survey) maps. These maps can be used with a grid square network plotted by CAASE3 as an overlay, or where the grid squares have been drawn directly on the map. For each pair of tracks, the user can visually estimate the distance in crossing the grid square as compared to the maximum distance possible across the grid square.

Then the overriding weighting factor for a grid square is a combination of the number of tracks crossing it and the relative length of the crossing distance for each. Recall that the effective apportioning factor is the product of the weighting factor and the assigned objective apportioning factor, in this case, grid square side length. Because the overriding weighting factor that should be assigned to a grid square includes both the number of tracks and the relative length of each, it is suggested that the user establish an arbitrary scale to include both terms. For example, a scale of 0.0 to 10.0 could be used. One pair of tracks, crossing the grid square along the maximum length path, would be assigned a 1.0, two pairs of tracks along the same path a 2.0 etc. For tracks across the grid square along some path less than the maximum distance, each pair of tracks can be assigned a fraction of 1.0. On a scale of 0.0 to 10.0, the following figures are examples of the suggested procedure where ++++++ will denote a single pair of tracks and ———— will denote a double pair of tracks.

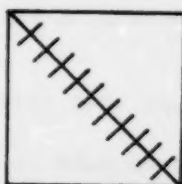


FIGURE 40-A. EXAMPLE OF RAILWAY LOCOMOTIVE WEIGHTING FACTOR OF 1.0
(2 KM X 2 KM GRID SQUARE)

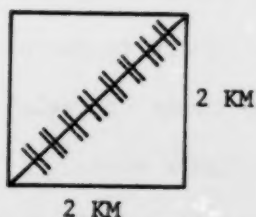


FIGURE 40-B. EXAMPLE OF RAILWAY LOCOMOTIVE WEIGHTING FACTOR OF 2.0

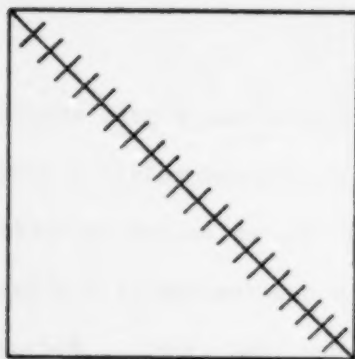


FIGURE 40-C. EXAMPLE OF RAILWAY LOCOMOTIVE WEIGHTING FACTOR OF 1.0
(4 KM X 4 KM GRID SQUARE)

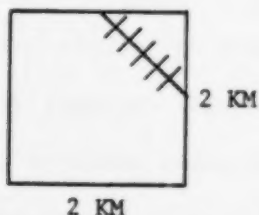


FIGURE 40-D. EXAMPLE OF RAILWAY LOCOMOTIVE WEIGHTING FACTOR OF 0.5
(0.5)

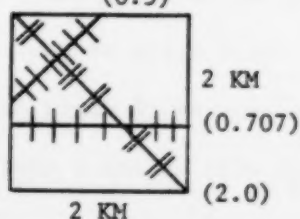


FIGURE 40-E. EXAMPLE OF RAILWAY LOCOMOTIVE WEIGHTING FACTOR OF 3.21

The examples in Figures 40-A through 40-E illustrate that the count of tracks and how they cross the grid squares make up the user-supplied overriding weighting factors input to CAASE4. The 1.0 weighting factor in Figure 40-A, (a 2 km by 2 km grid square) and Figure 40-C (a 4 km by 4 km grid square) will be multiplied by the grid square side length by the CAASE4 program. This will cause the grid square represented by Figure 40-C to receive an allocation of twice the amount of fuels and associated emissions as the grid square represented by Figure 40-A.

If the CAASE user does have relative traffic data for the track segments, it can be incorporated into the weighting factor procedure.

For those source categories using assigned population or housing counts, the user-provided overriding weighting factors are handled by CAASE4 in the same manner as the examples above. The effective apportioning factor for each grid-square-source-category combination is the product of the user-provided overriding weighting factor (or the default value of 1.0) times the assigned objective apportioning factor. It is fairly straightforward to use maps to locate airports, waterways and railroads. However, population and housing distribution maps are not as readily available. The CAASE user can refer to the CAASE2 output for these housing and population counts for each grid square (or portion thereof) for each county.

The CAASE4 program reads the grid file output from the CAASE2 program. This file contains the fractional area, contained housing, and contained population, for that portion of each grid square within the county, in addition to location coordinates and county identification. The assigned housing and population counts are included in the CAASE2 printout (see Figure 8).

Using the allocation of distillate oil used for residential fuel (and its associated emissions) as an example, the user is probably very limited in providing any overriding weighting factors. The user probably does not have enough detailed information on the distribution of residences using distillate oil (as compared to other fuels) to improve on the CAASE default method of allocating solely on total housing distribution. However, the user may, for example, be able to estimate that the percentage of residences using distillate oil and located in the grid squares in one part of the county is twice that in the remainder of the county. In this case, the CAASE user could initialize the source category (number 3 in Table 21) to 1.0. Overriding weighting factors of 2.0 could then be input for the grid squares that had twice the percentage of residences using distillate oil.

If the CAASE user does not want CAASE4 to assign apportioning factors for a source category, then there are two easy ways to do this:

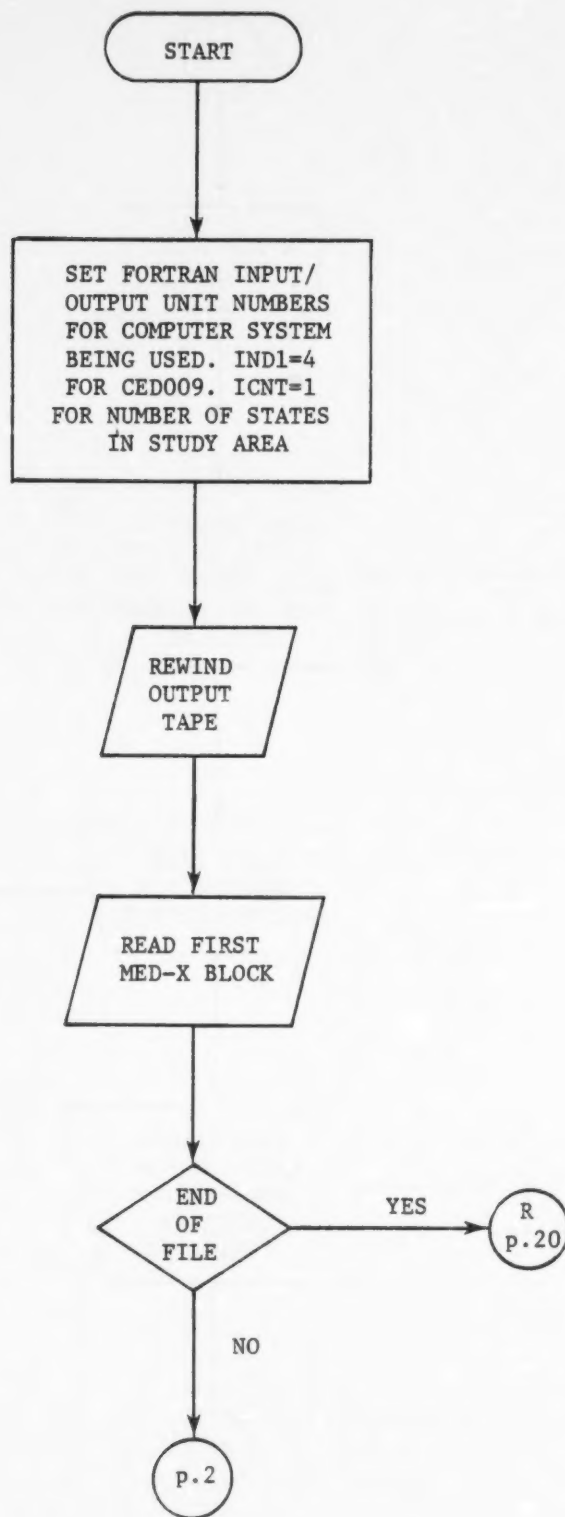
1. In running the CAASE4 program, the source category can be initialized to 0.0 and then no user-provided weighting factors are input. The zero coefficient for apportioning will effectively eliminate the source category.
2. In running the CAASE5 program, the source category fuels (throughput) on the Area Source Input card can be set to zero. In this case, no overriding action is necessary in running CAASE4.

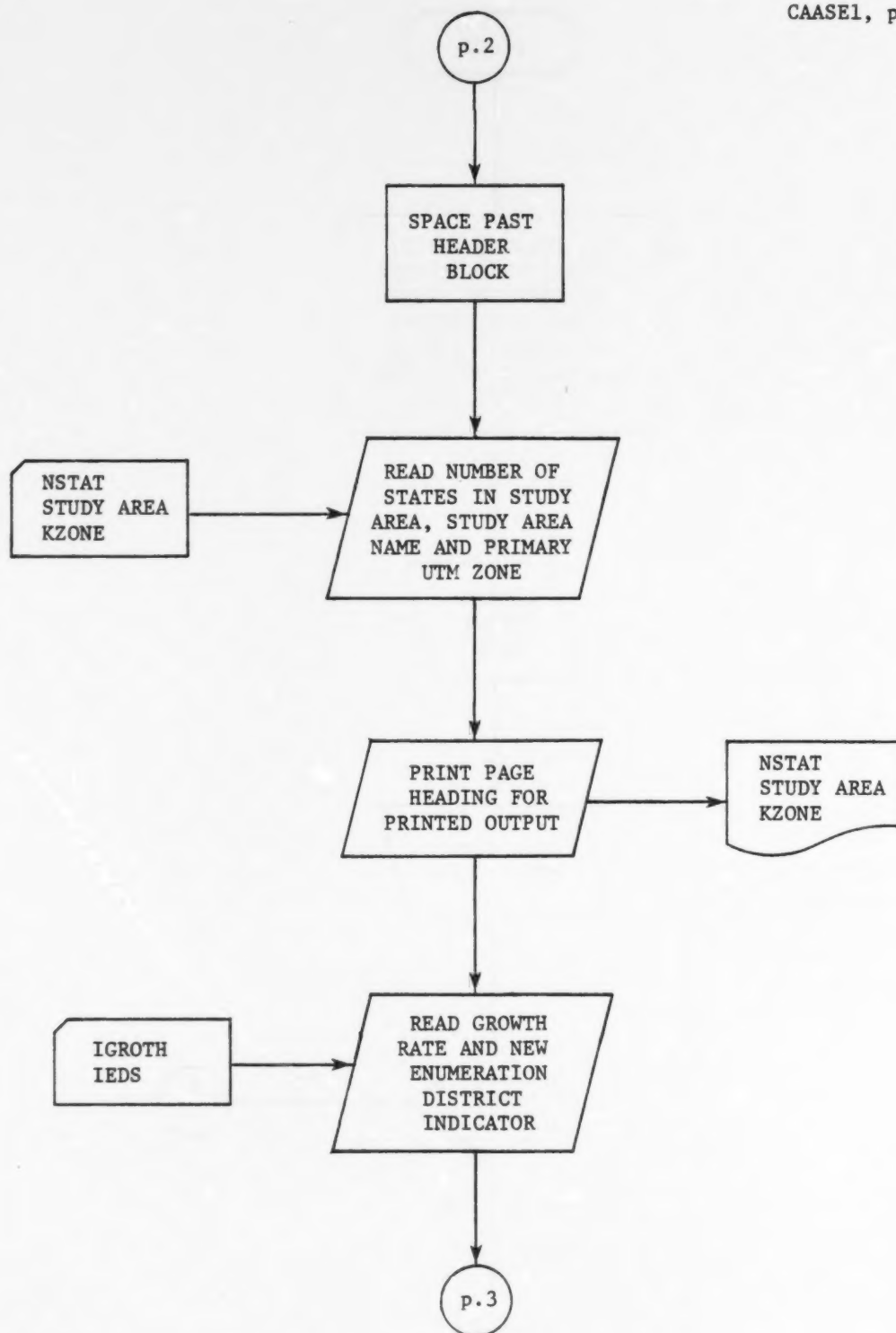
In either case above, the CAASE5 output tables would display a zero for all grid squares for the source category so excluded. Also, emissions for the source category would not be included in the grid square totals output on the dispersion model card images. The emissions for the source category could be calculated by another method and allocated manually by the user. These emissions could then be added, as appropriate, to the totals on the dispersion model card images output by CAASE5.

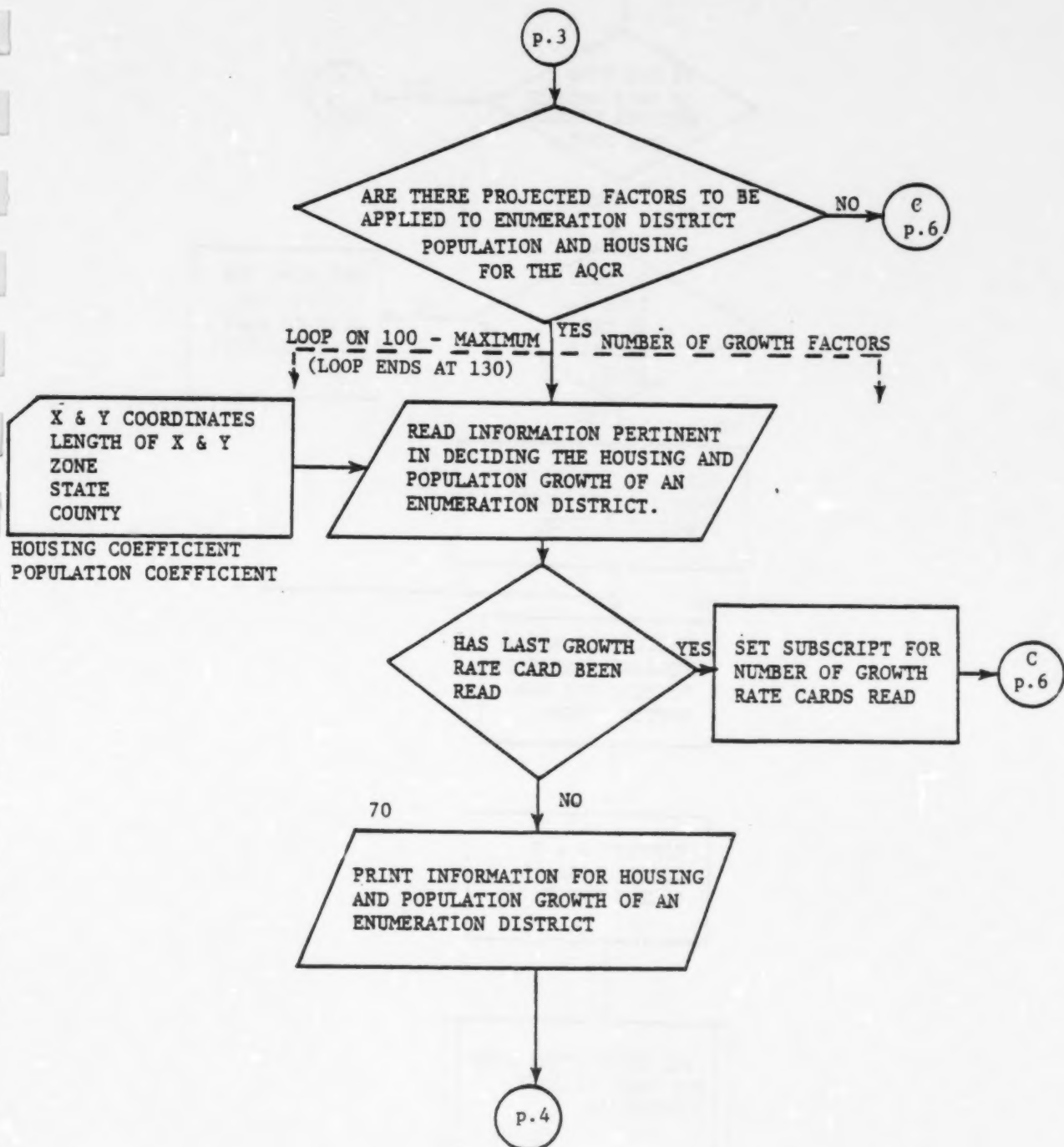
APPENDIX A

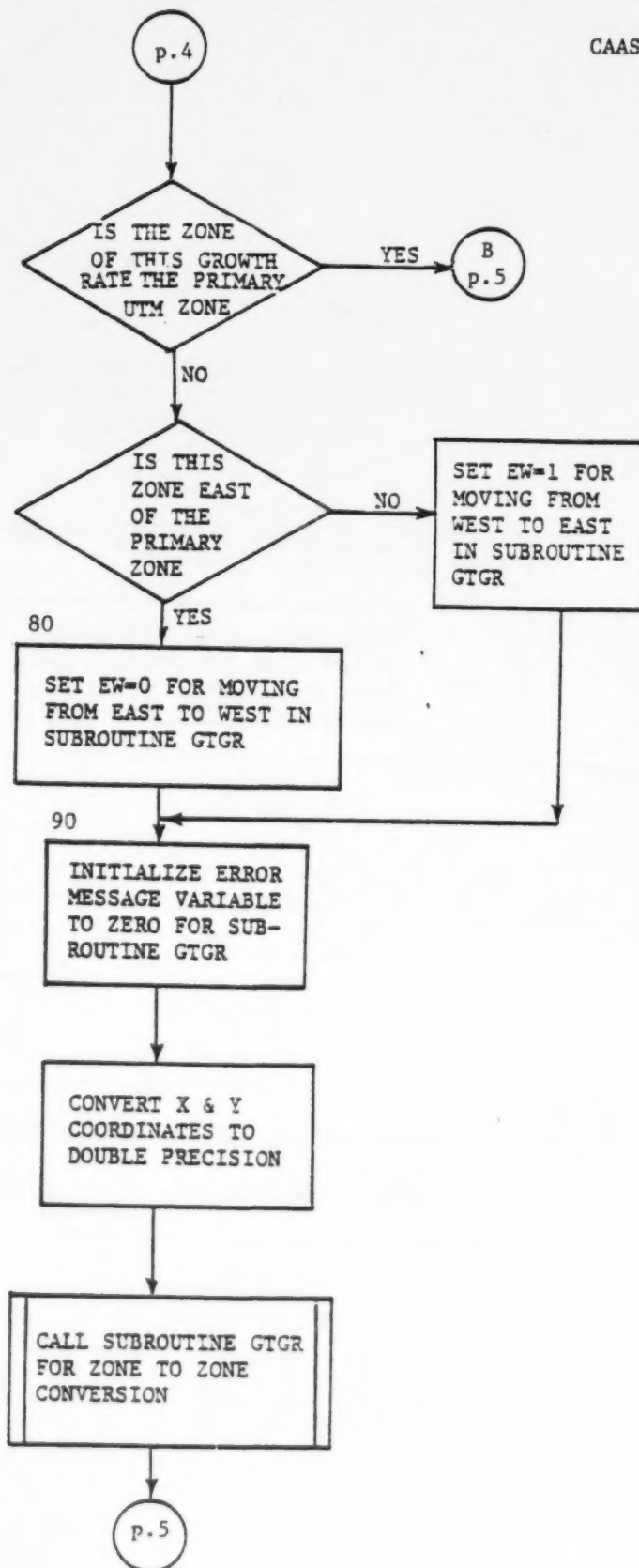
LOGICAL FLOWCHARTS AND FORTRAN SOURCE CODE LISTINGS

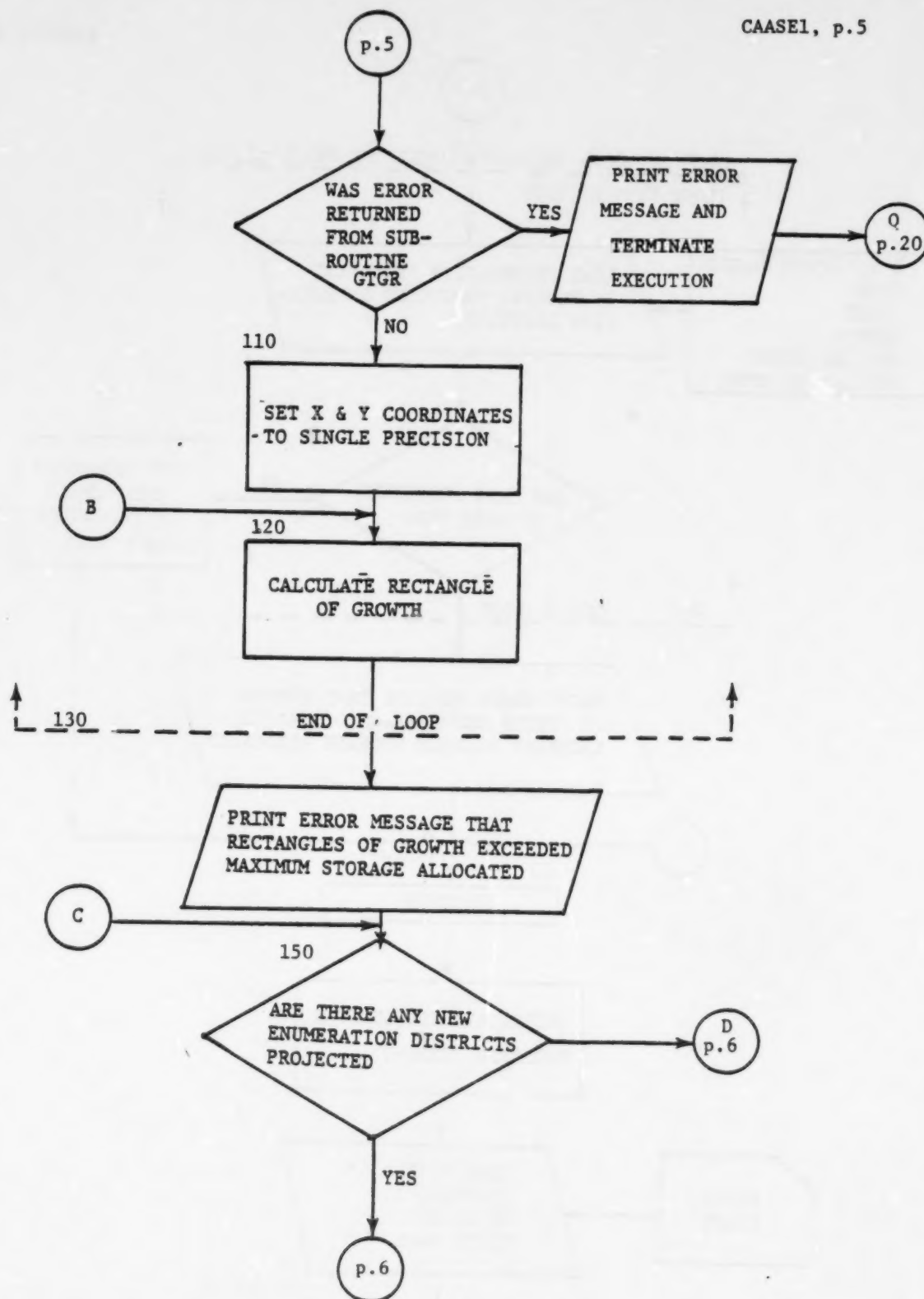
CAASE1 (and Subroutines)

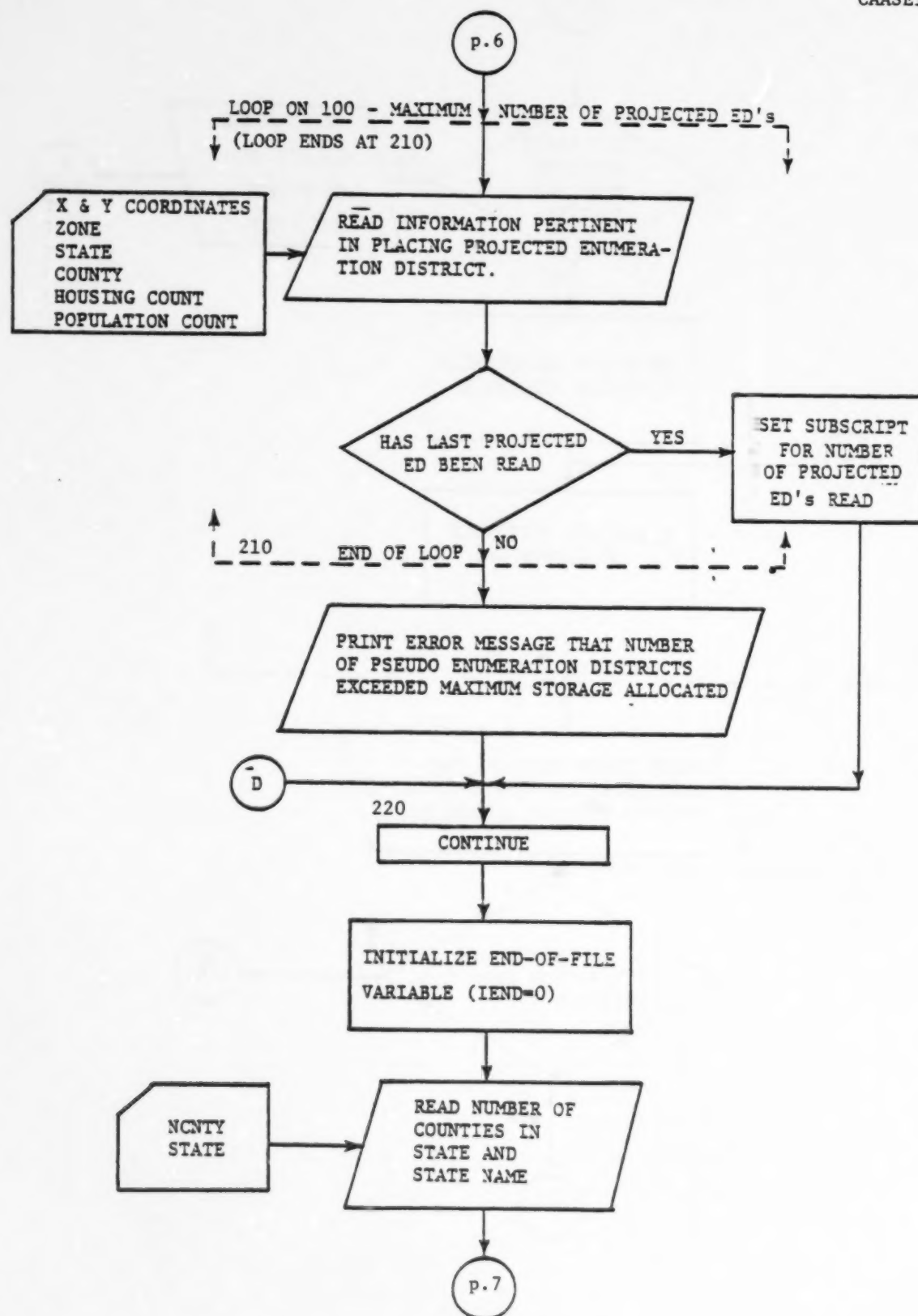


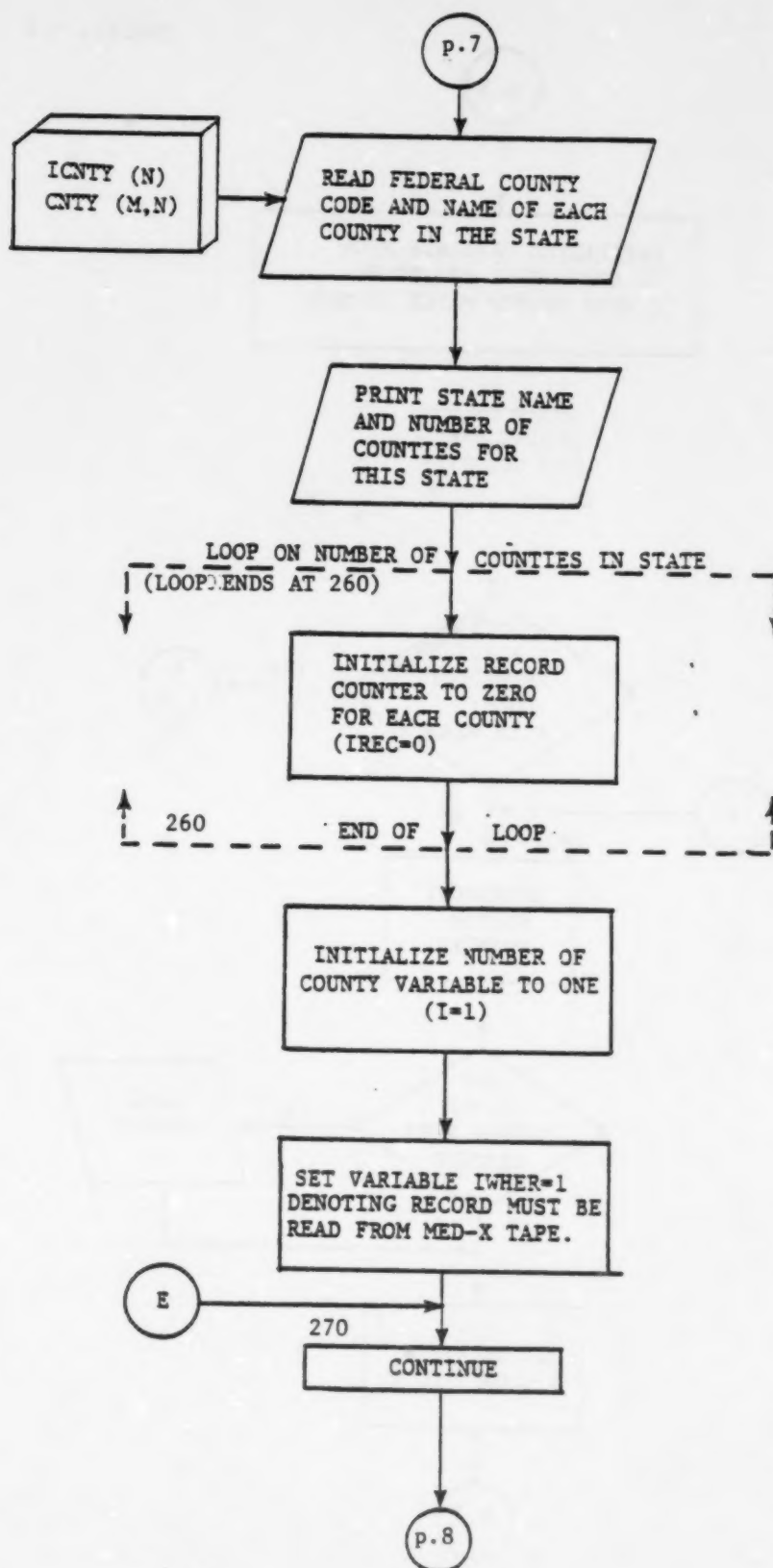


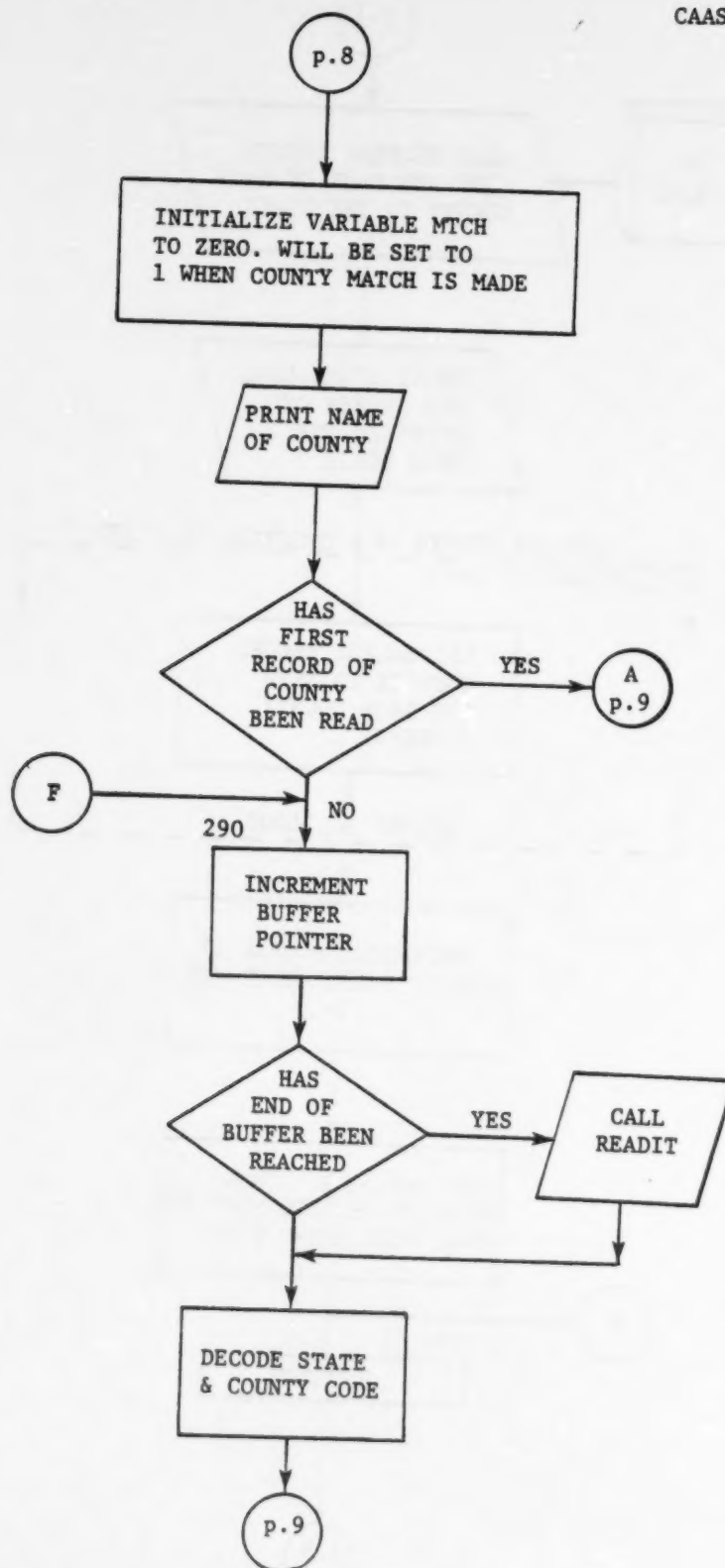


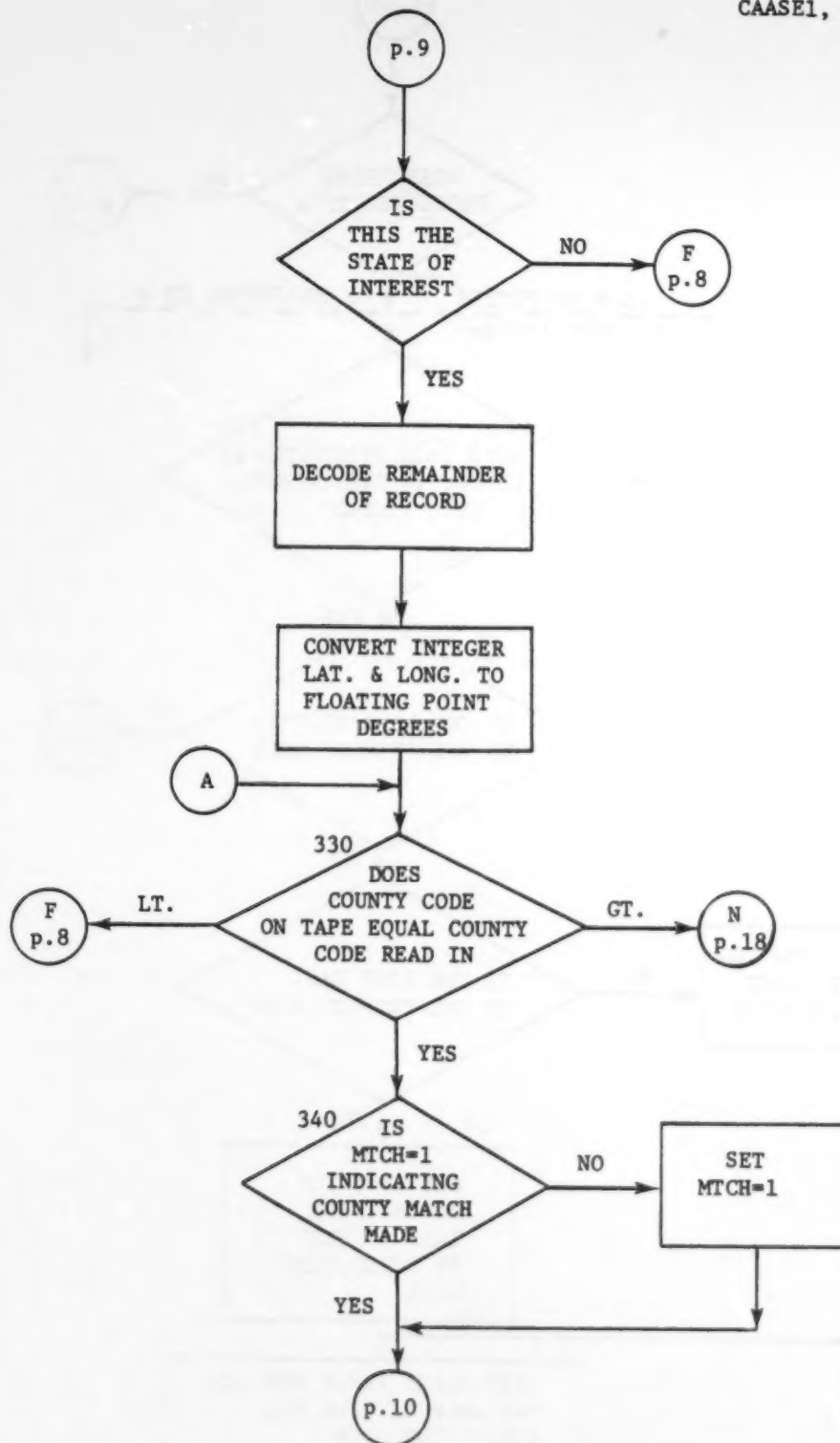


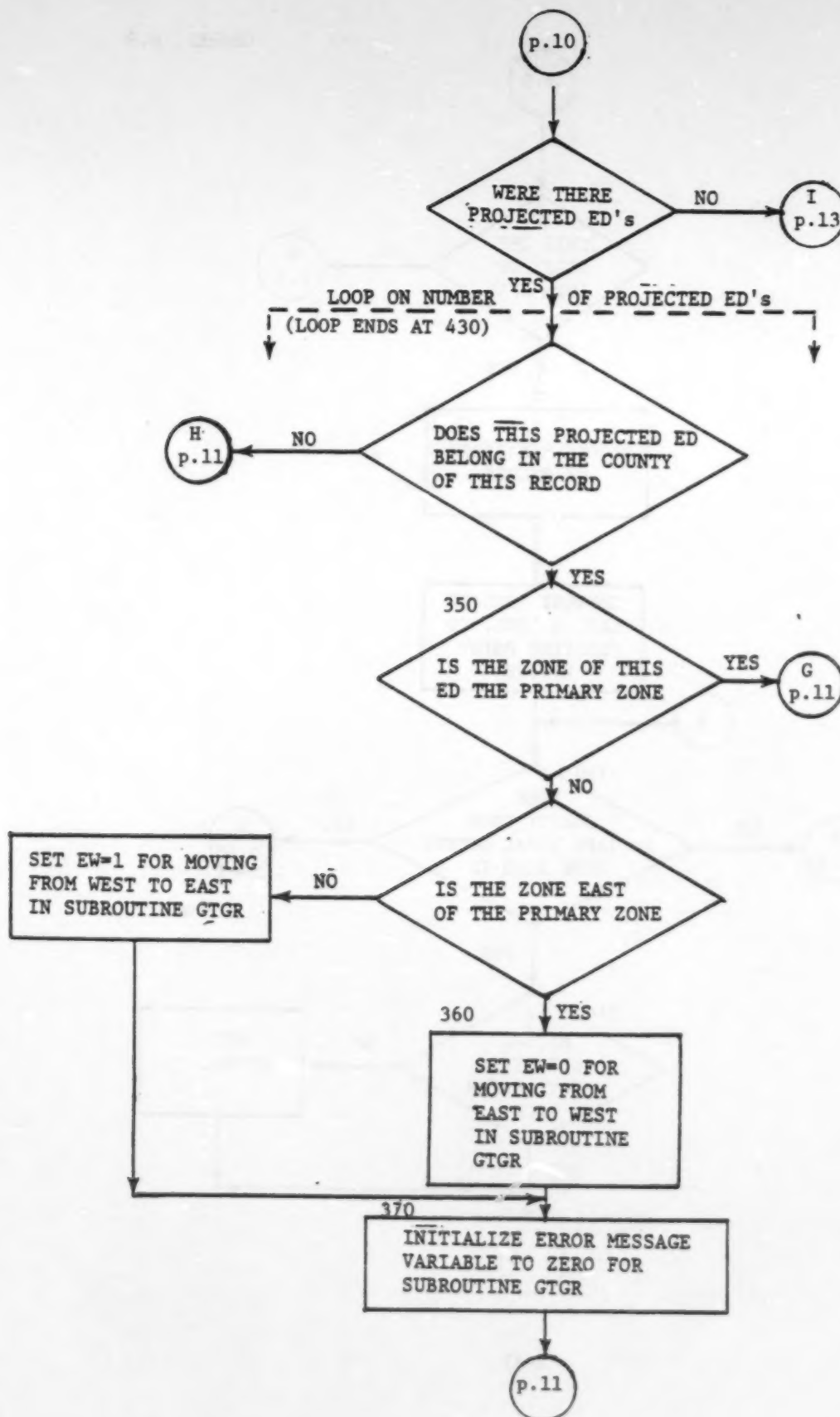


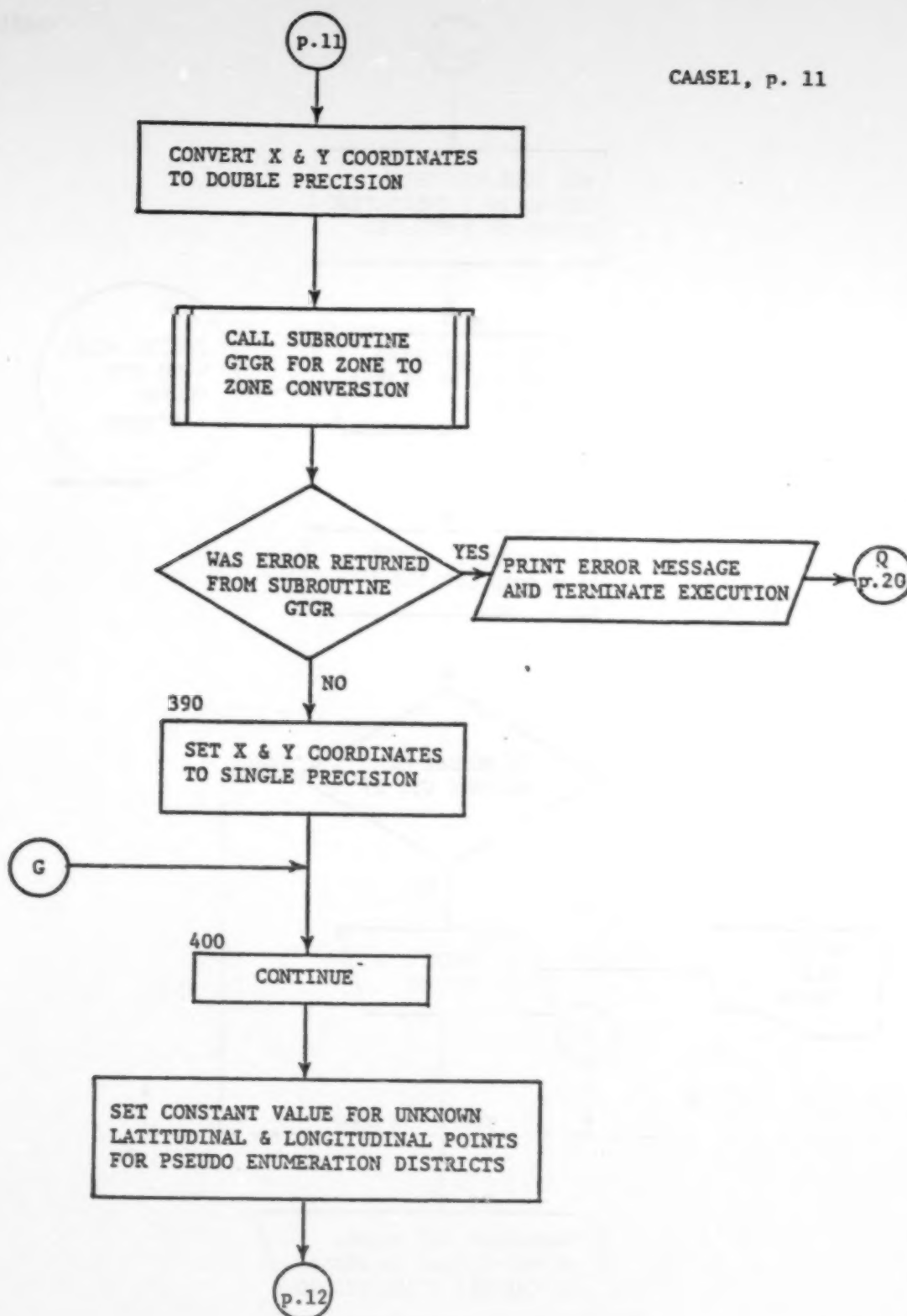


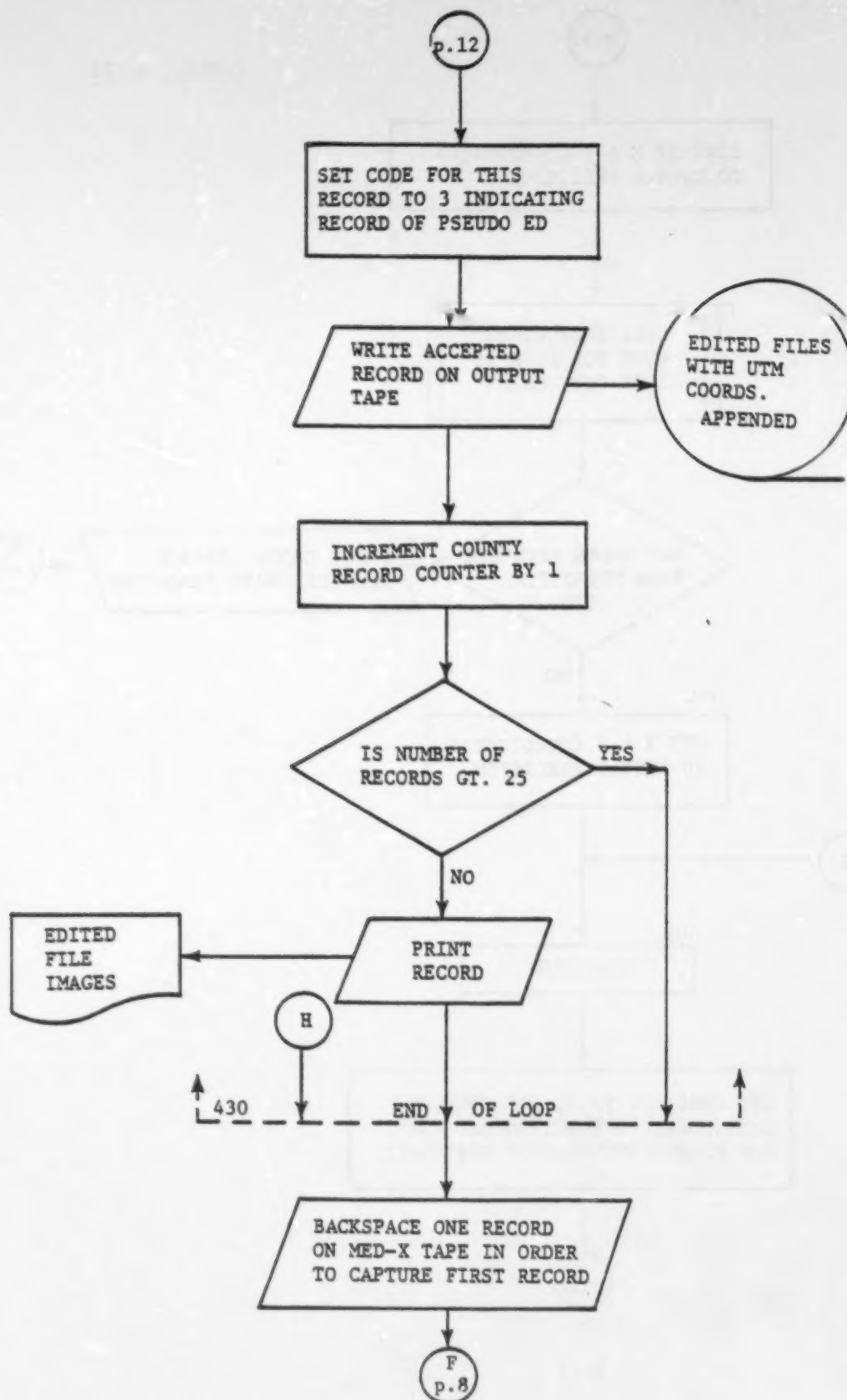


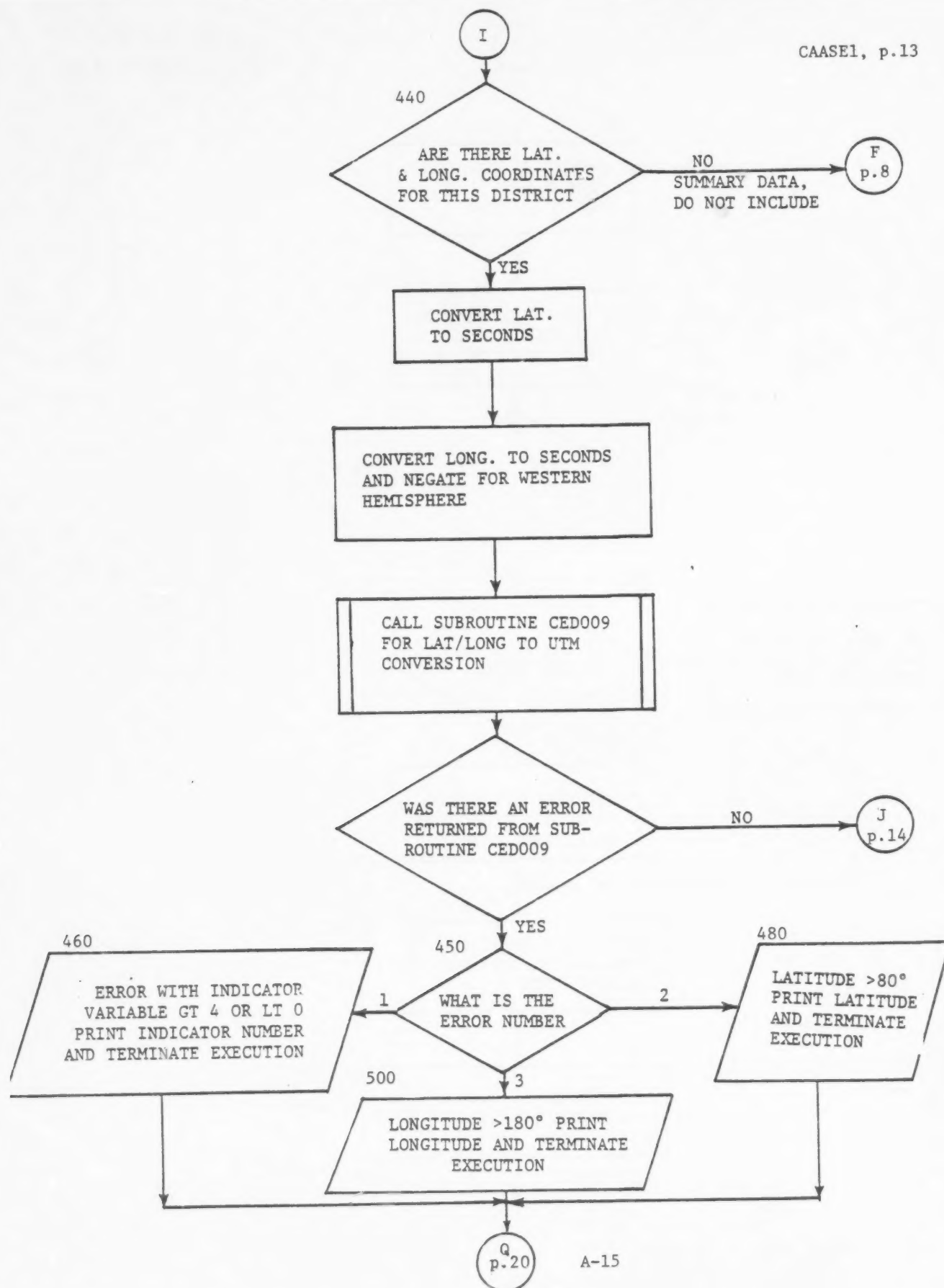


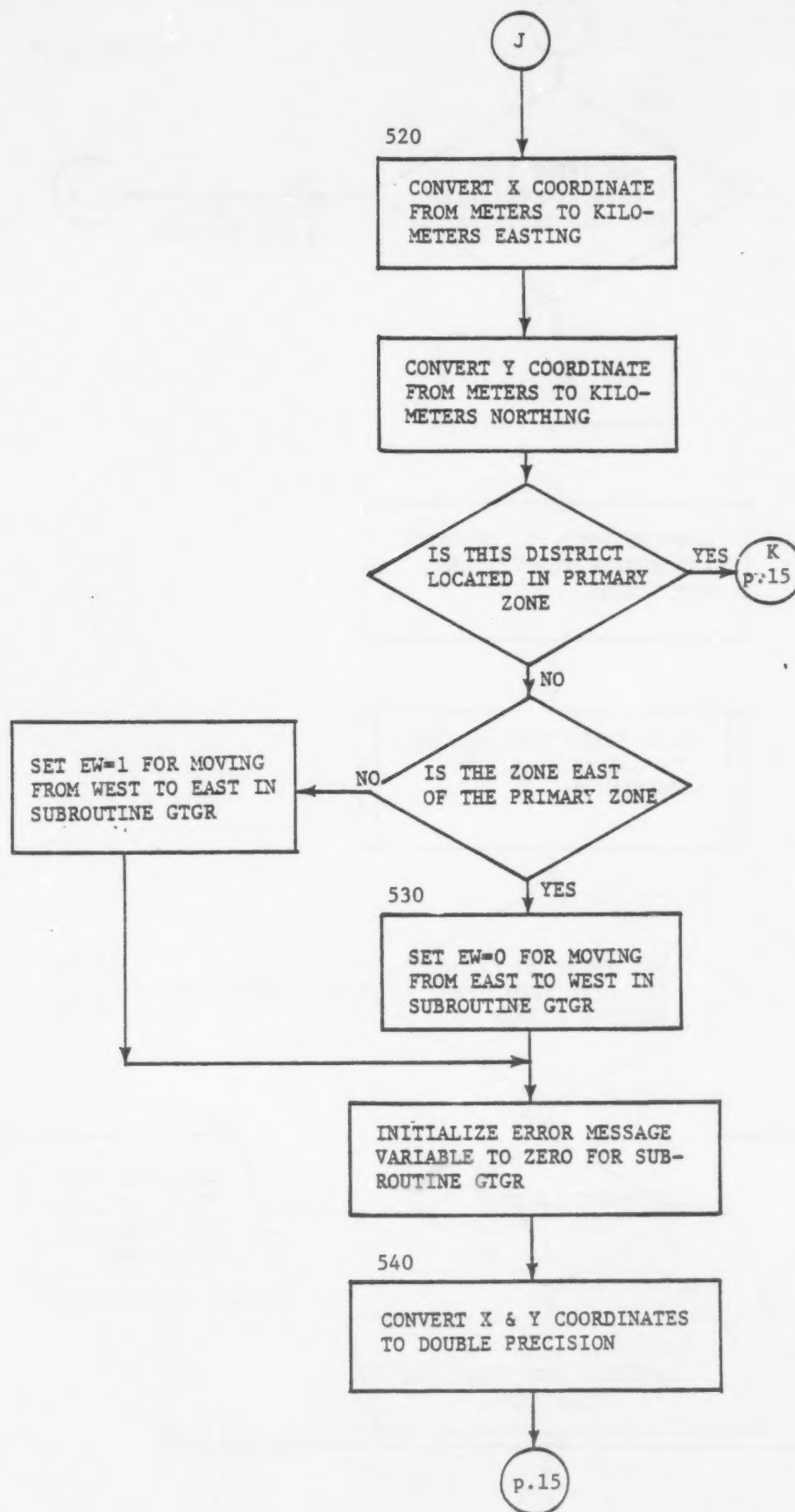


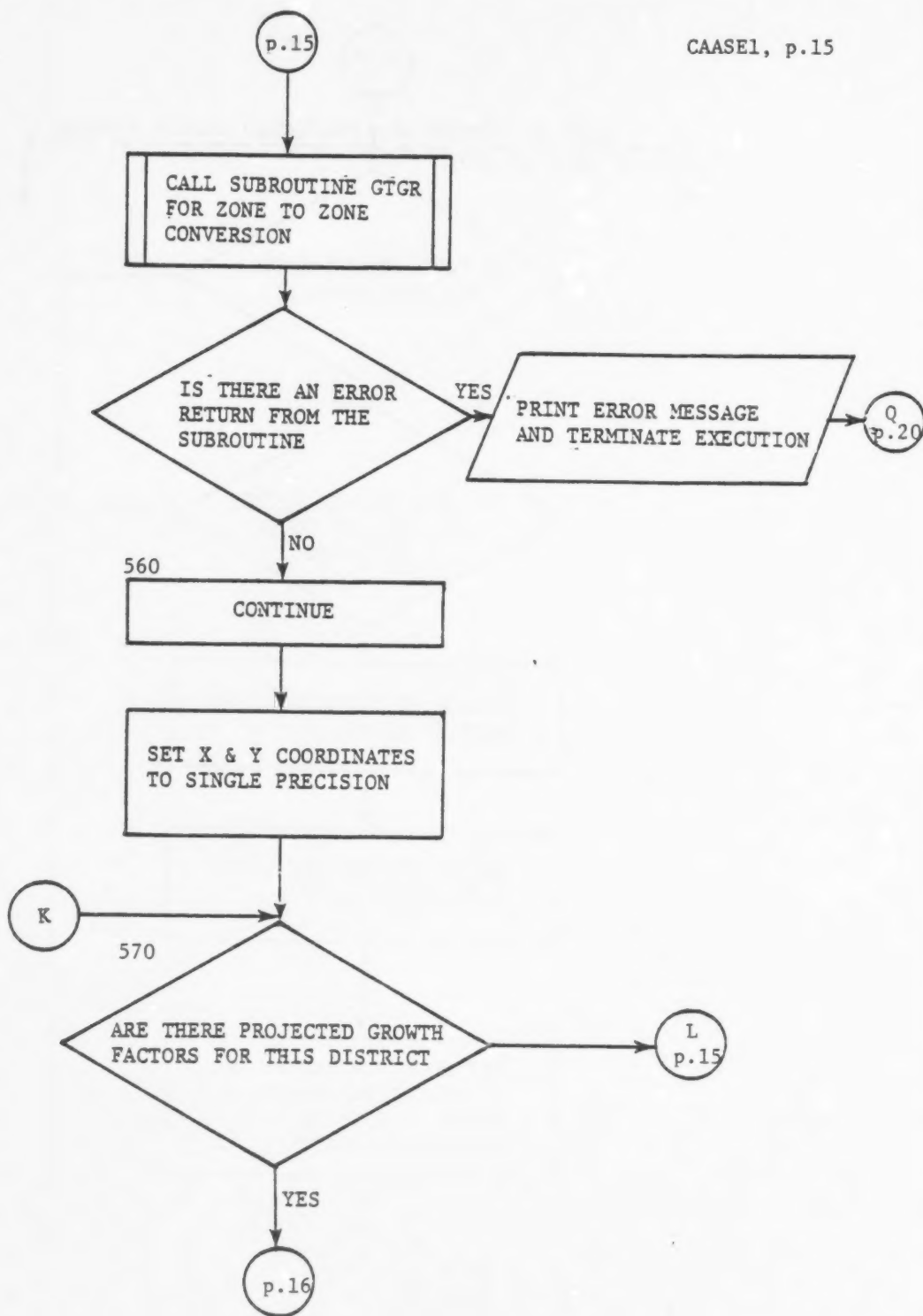






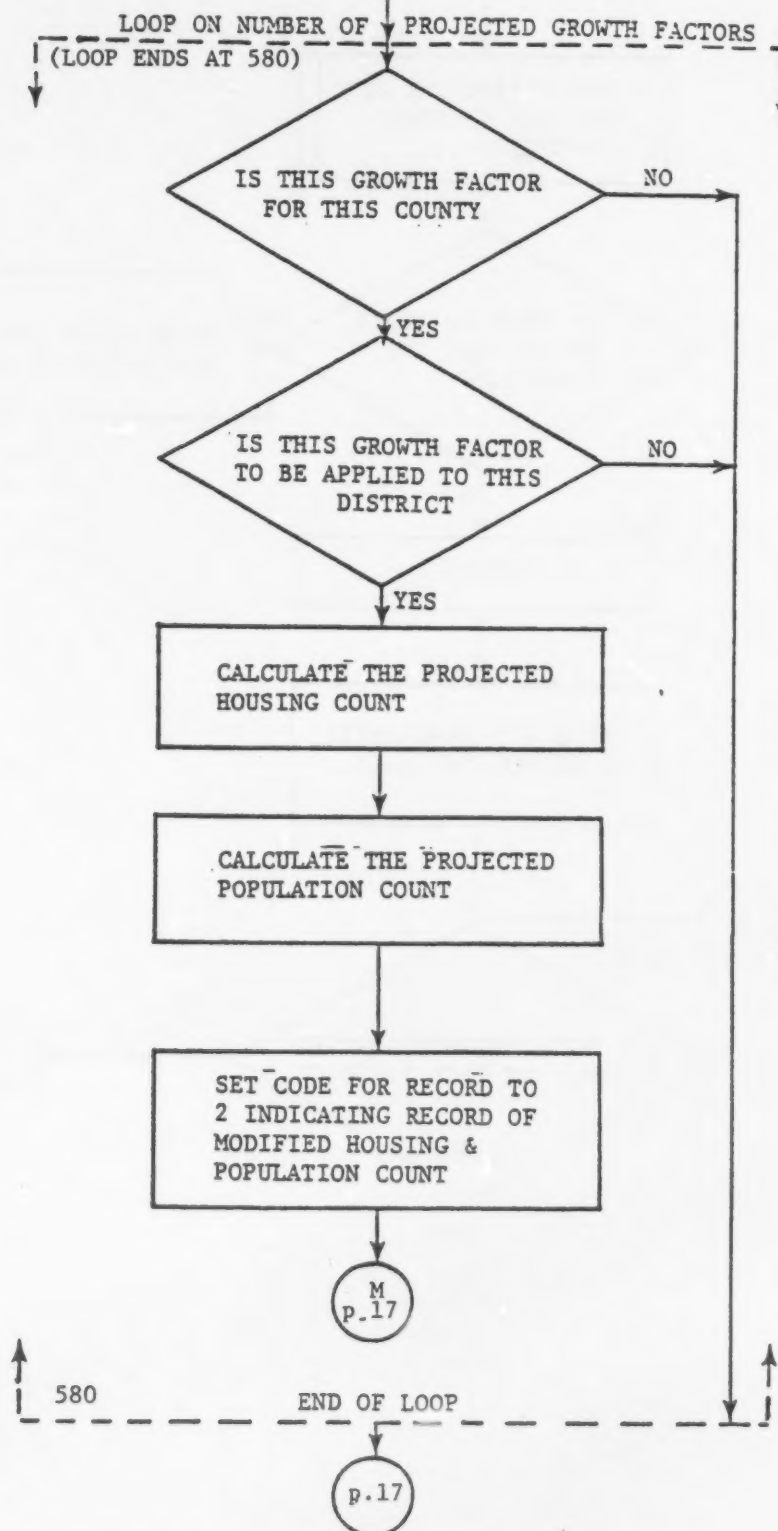


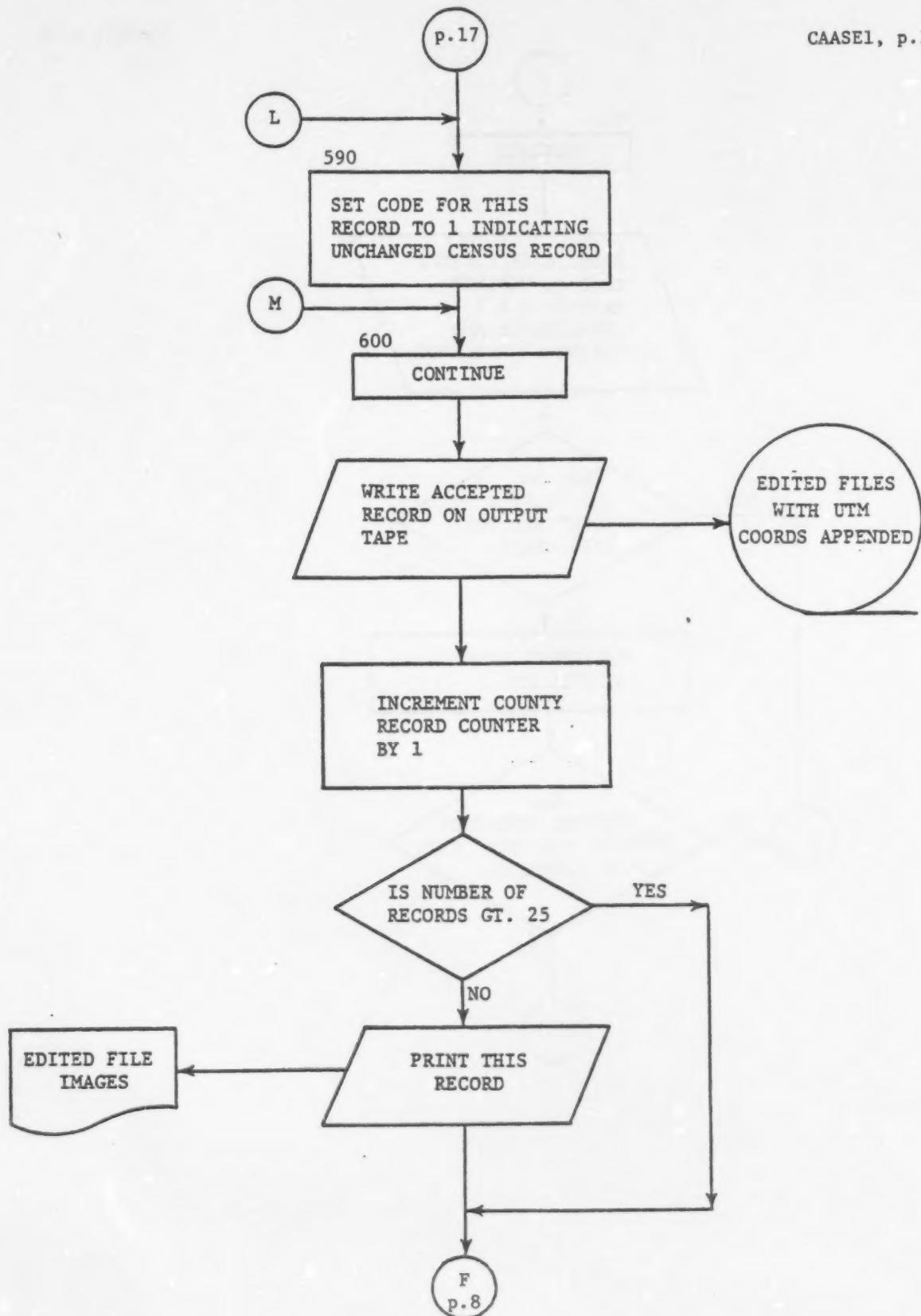


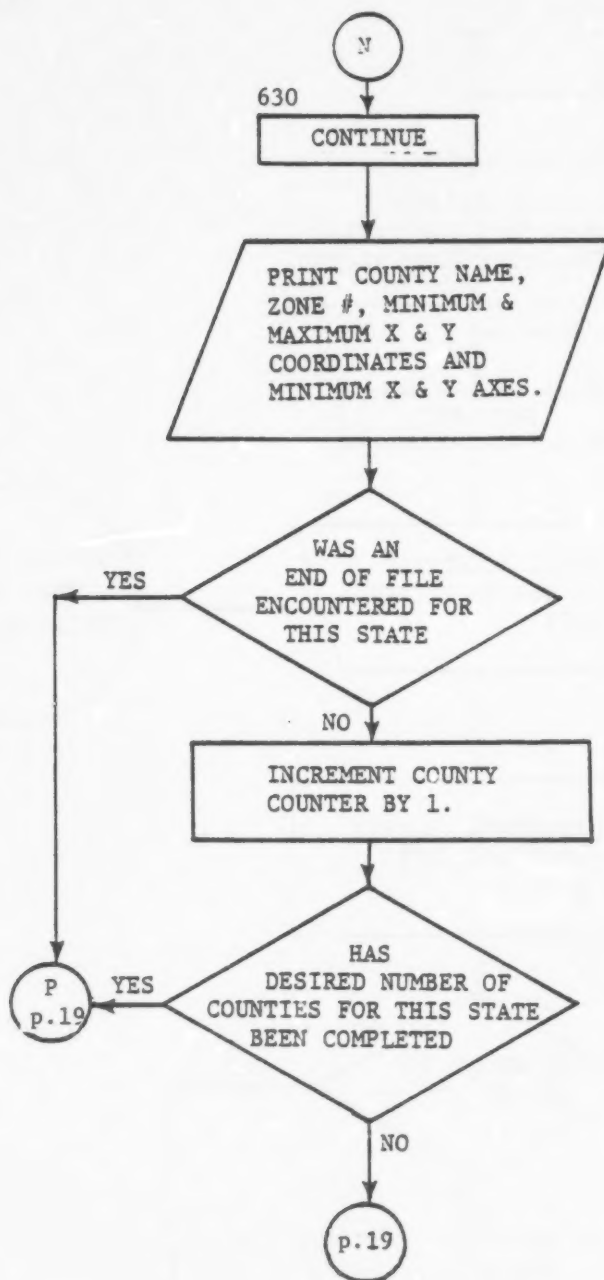


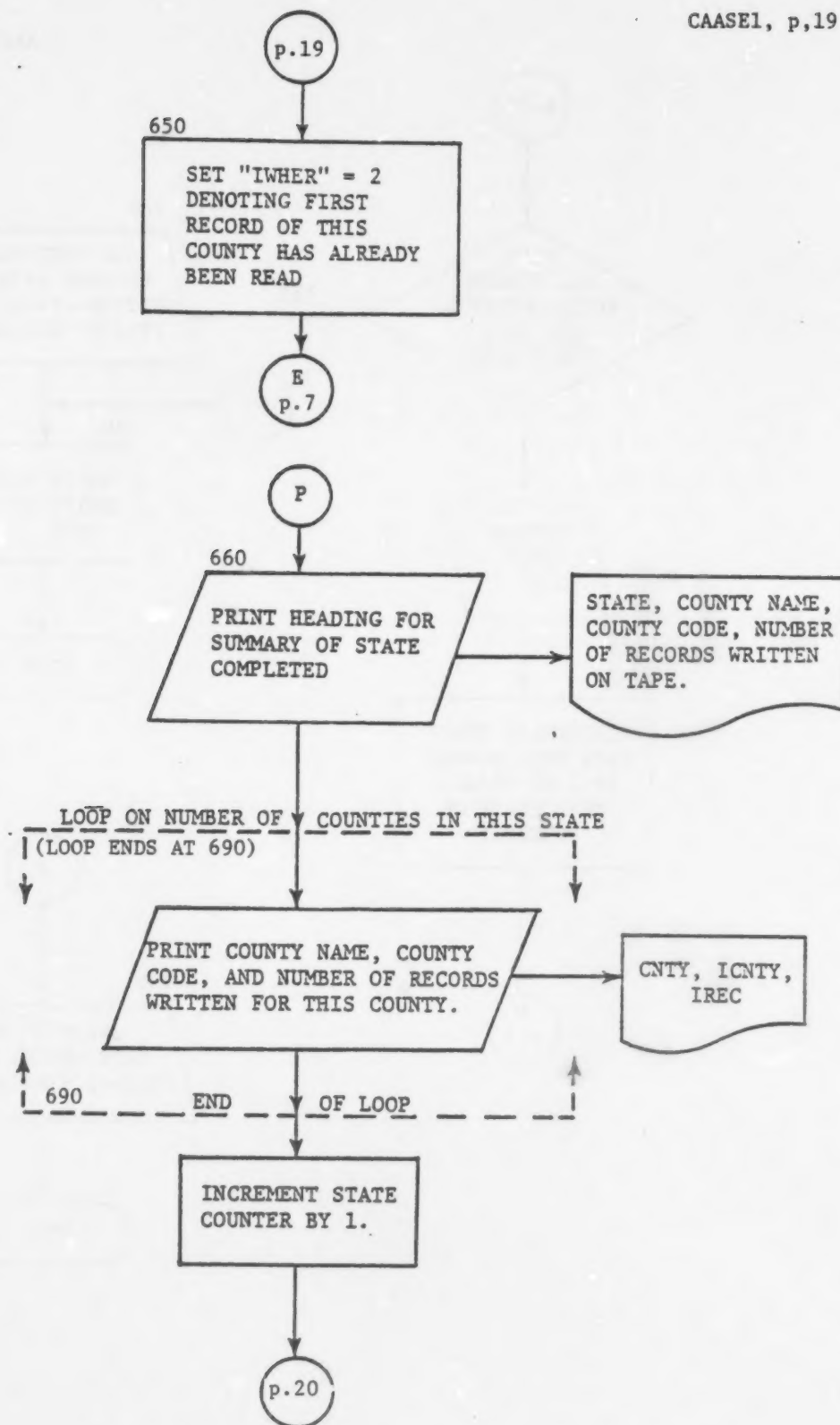
p.16

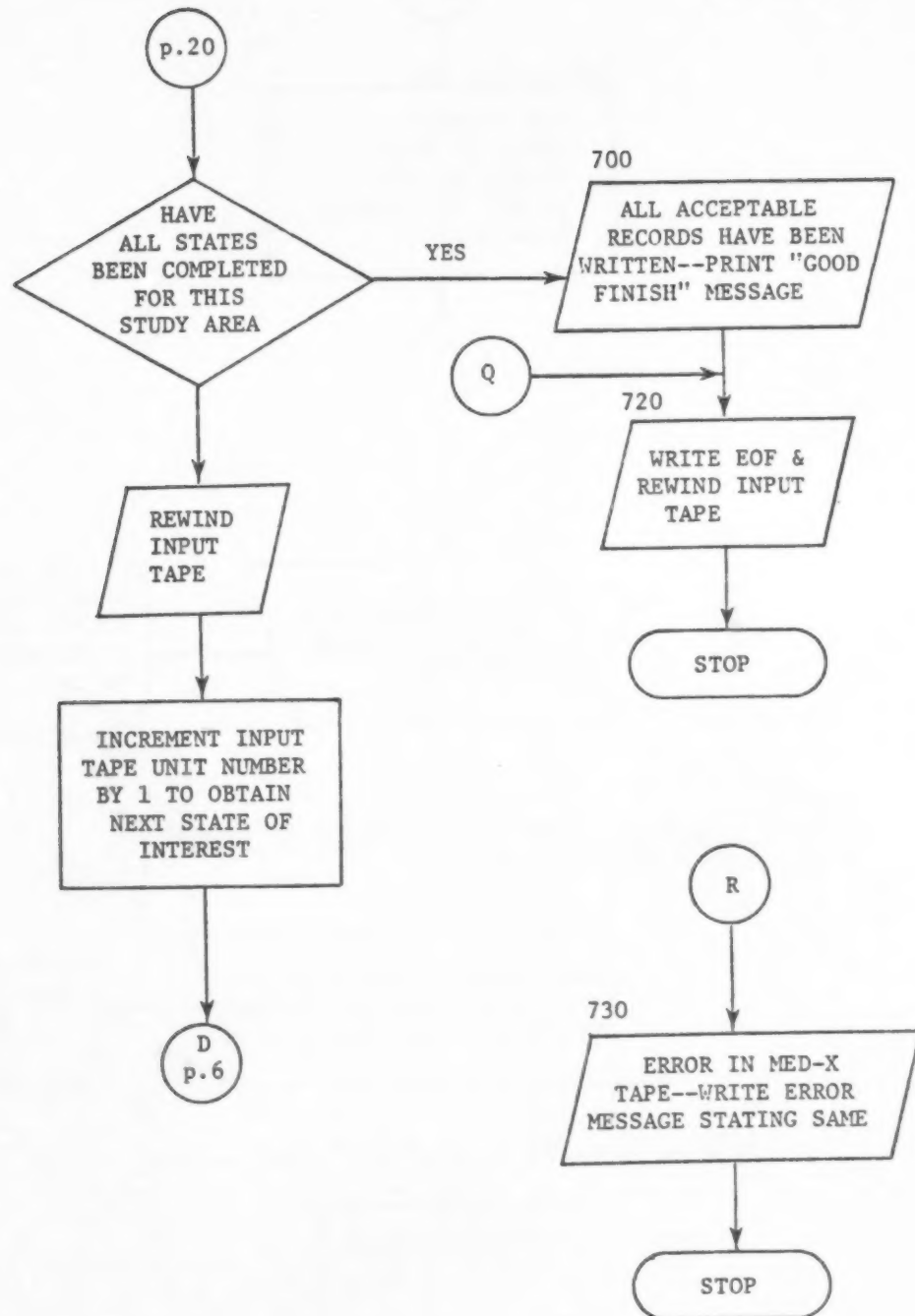
CAASE1, p.16

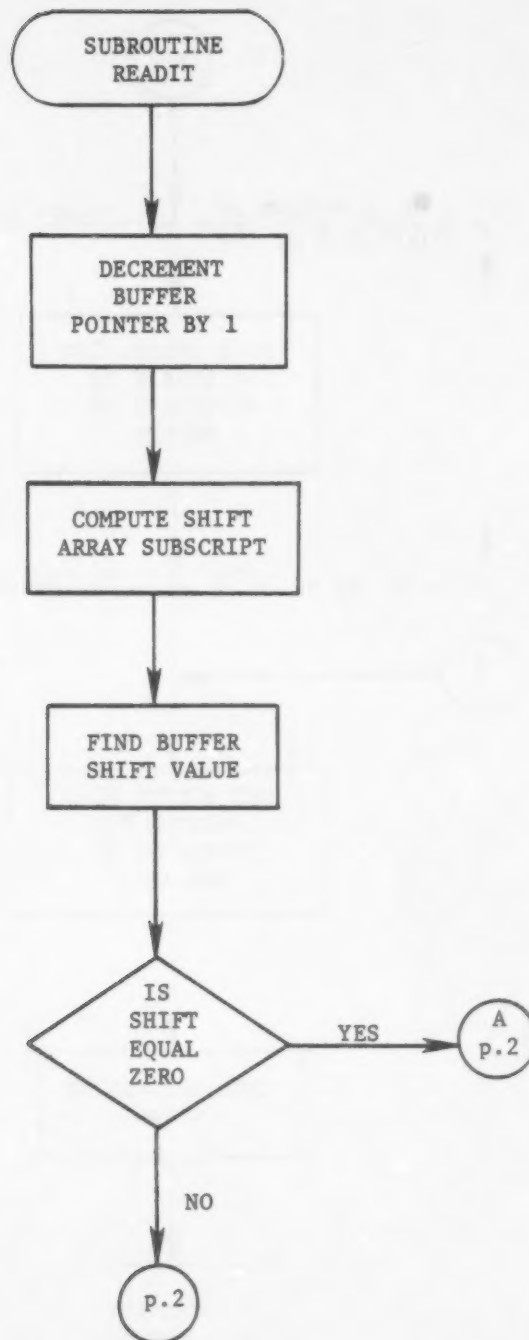


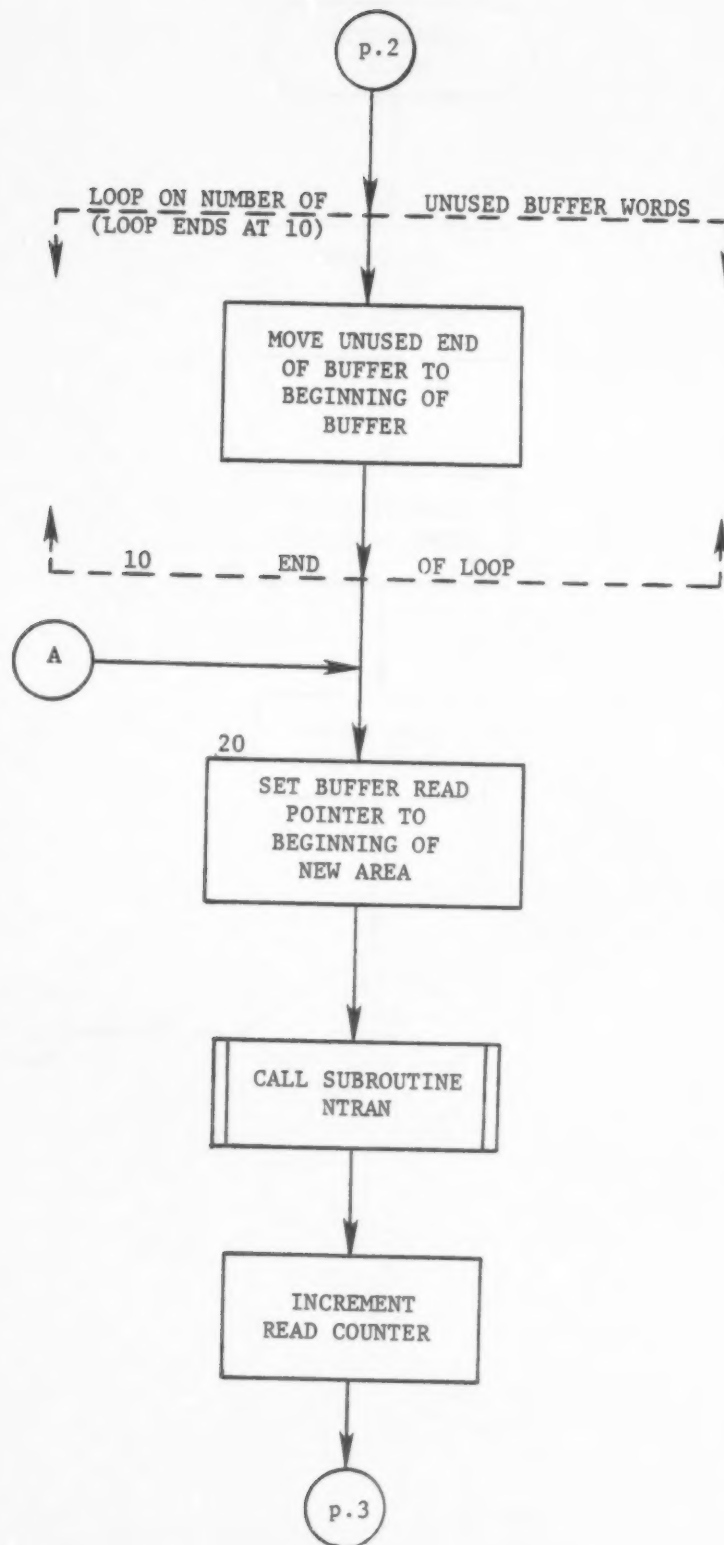


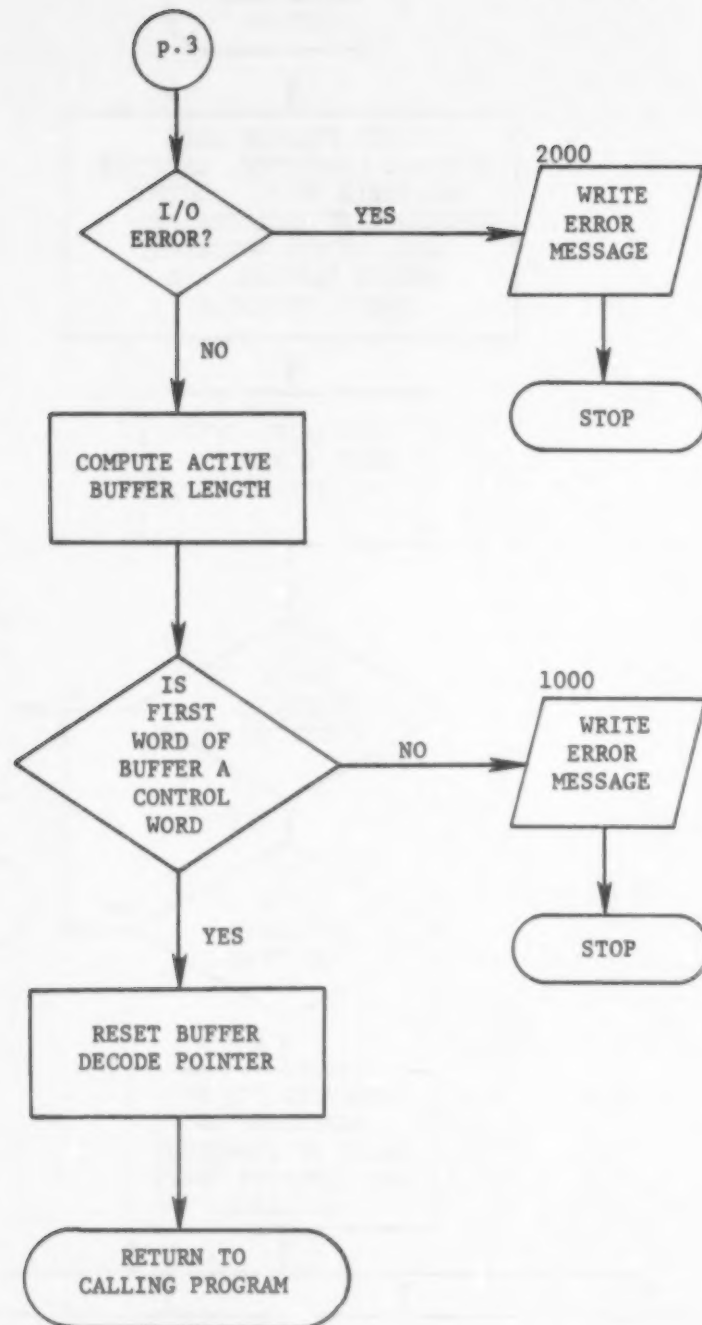


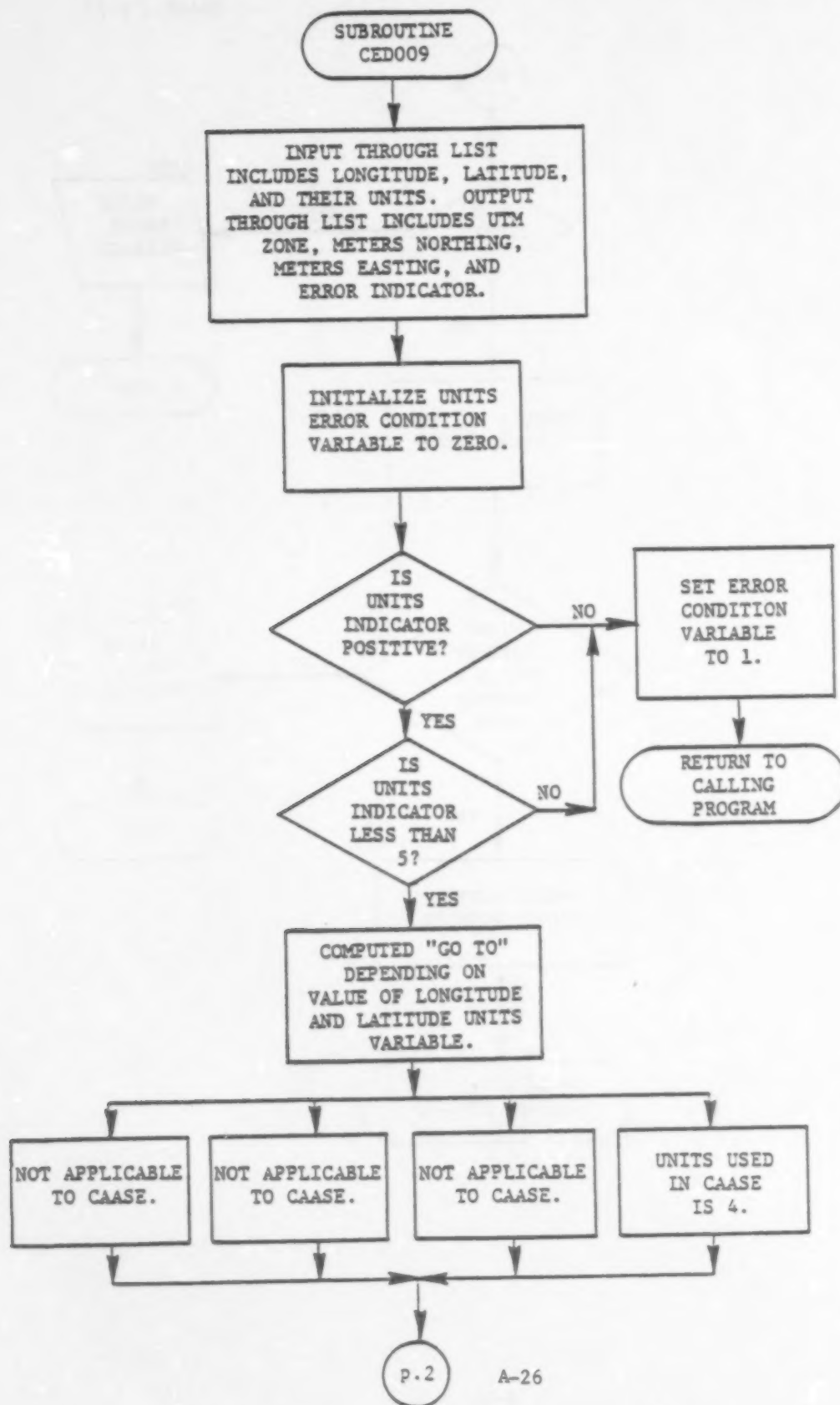


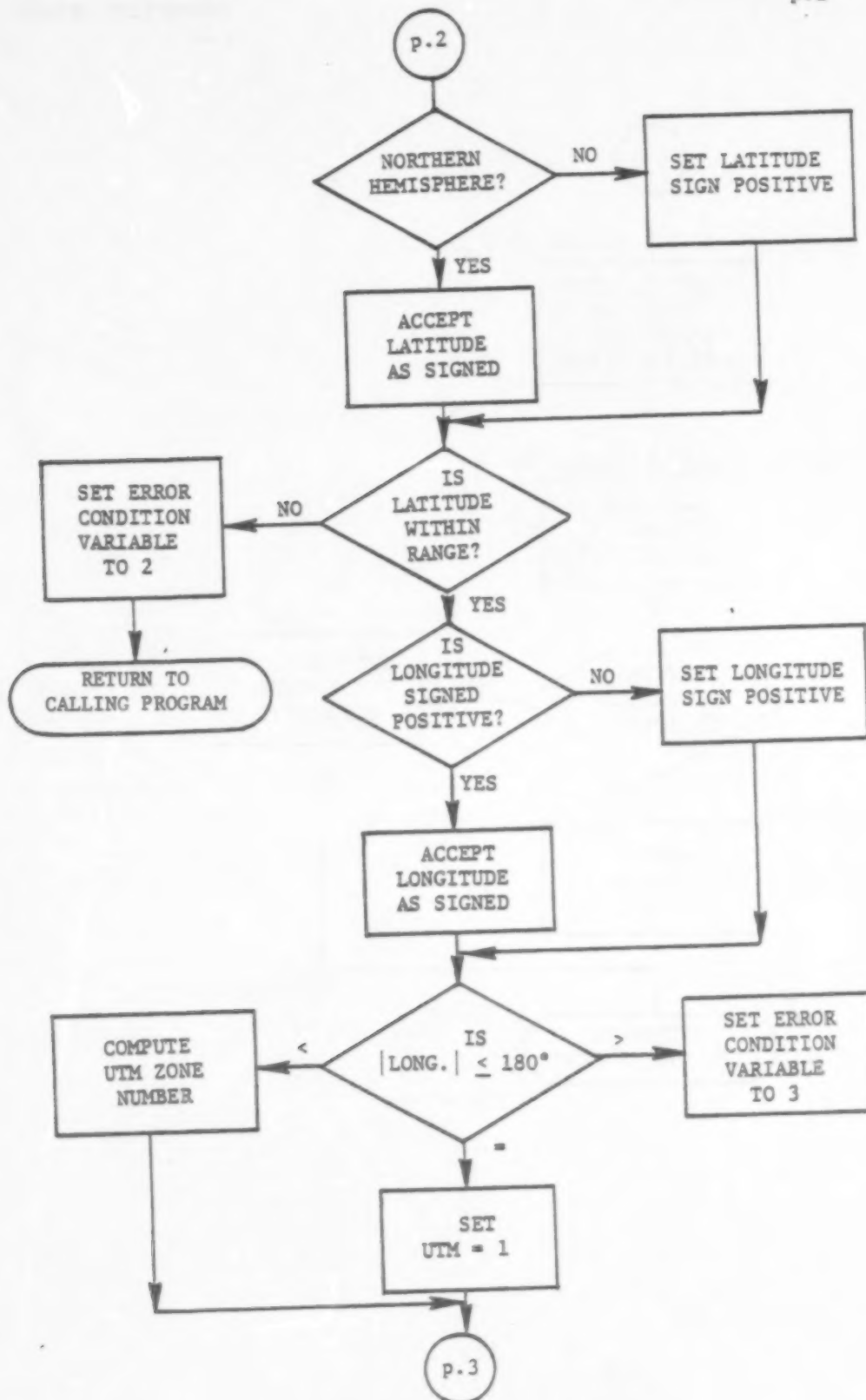


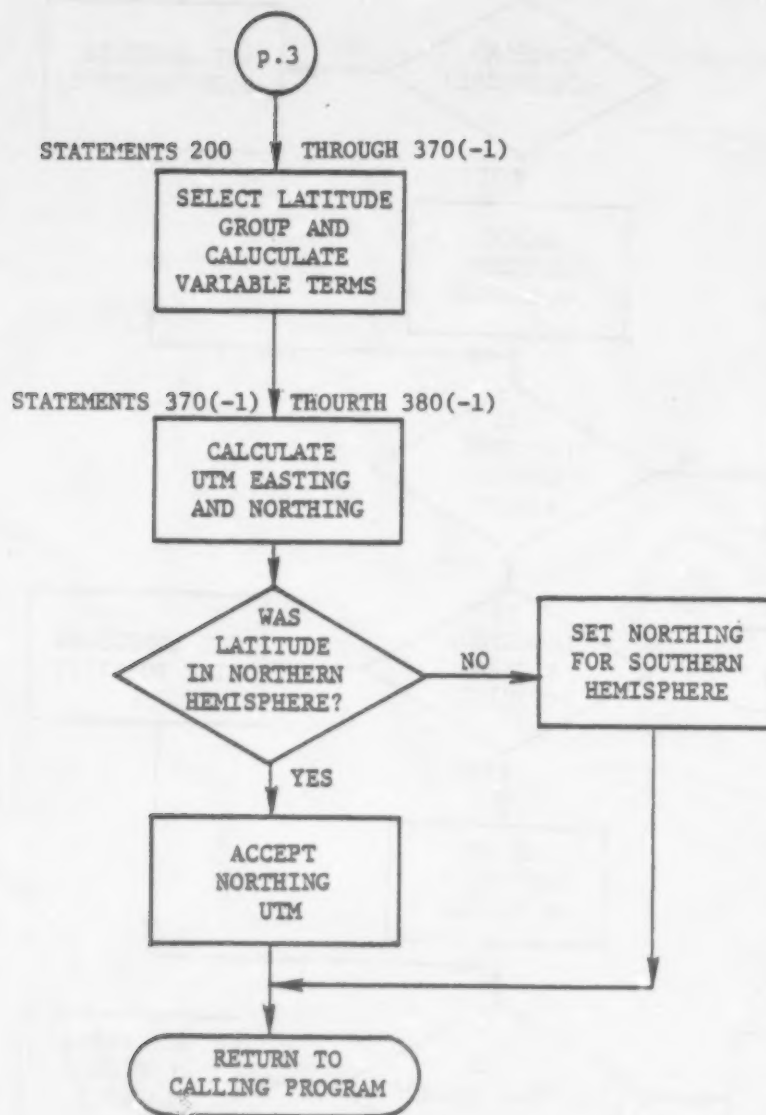


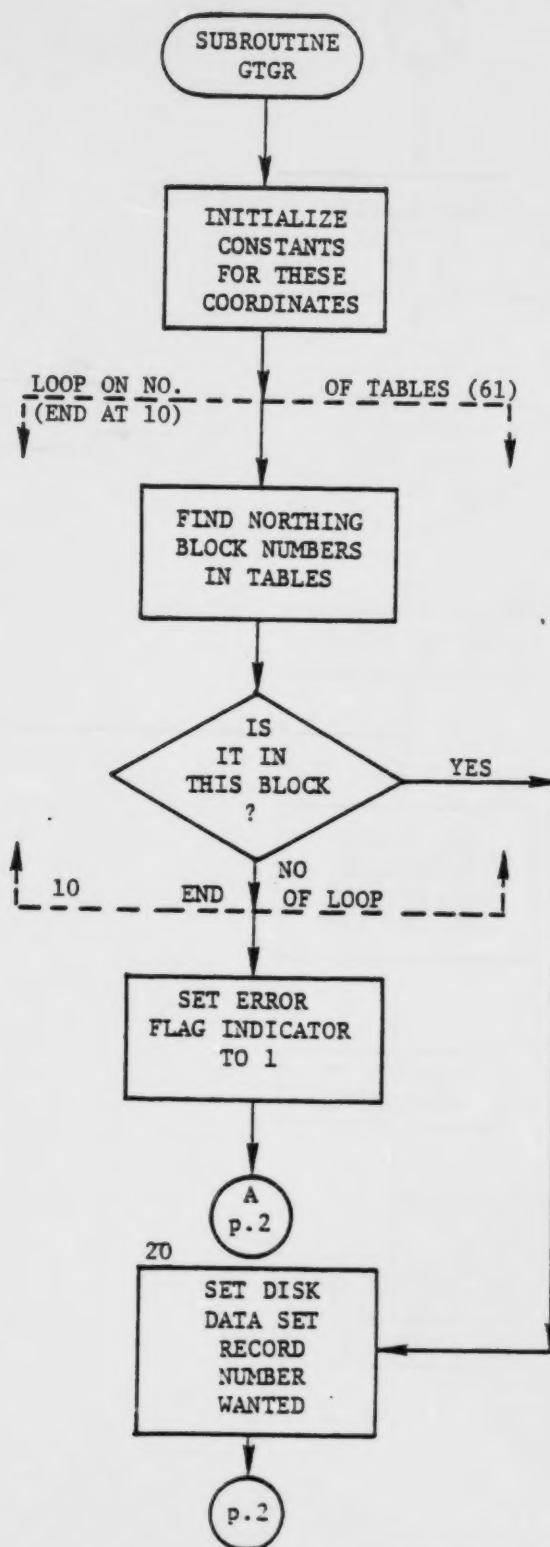




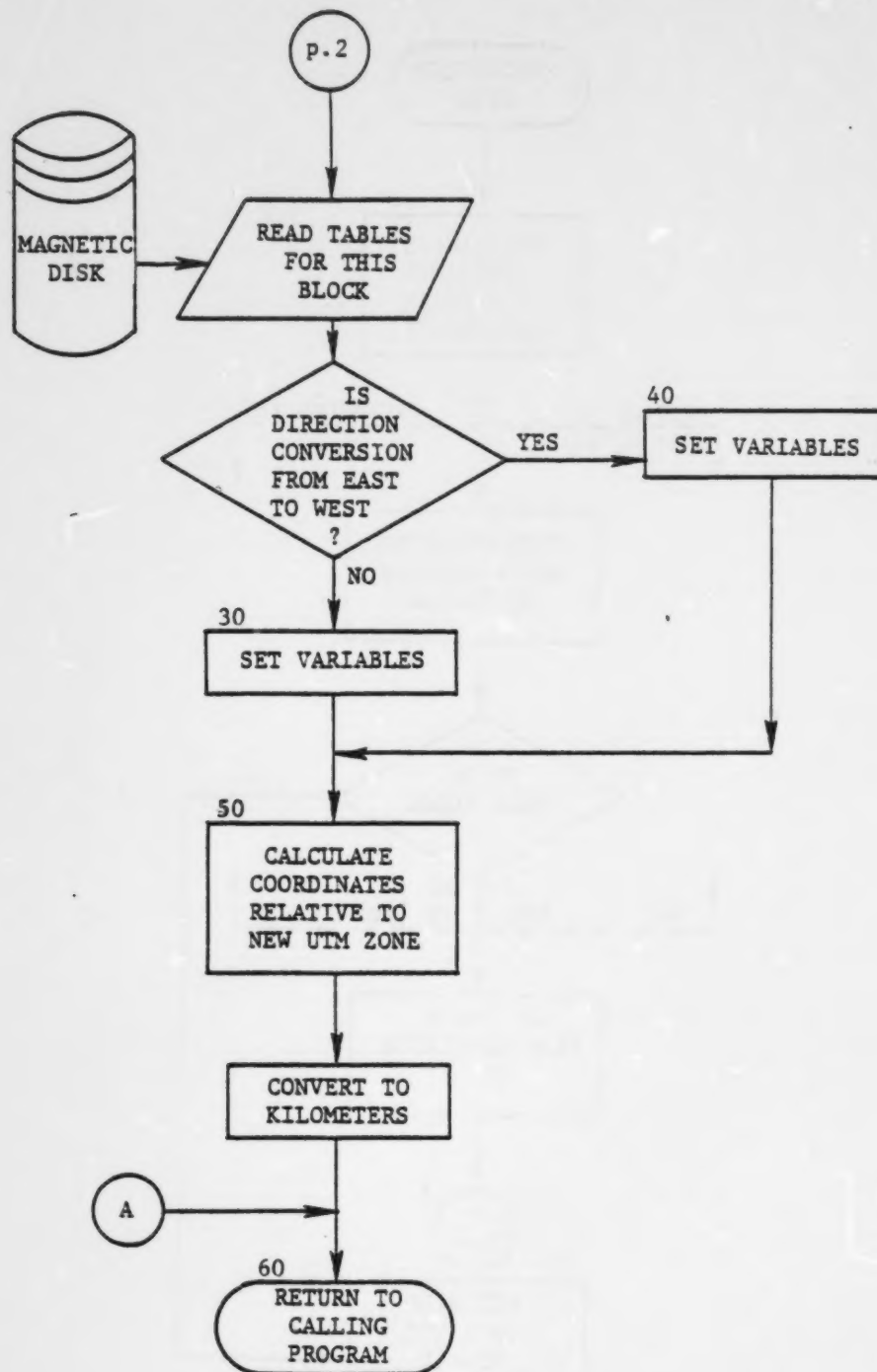








*OBTAINED FROM EPA WITHOUT DOCUMENTATION



```

C****PROGRAM NAME: CAASE1
C*** THIS PROGRAM IS DESIGNED TO EXTRACT ALL THE ENUMERATION DISTRICTS
C FOR THE COUNTIES THAT BELONG TO THE SAME STUDY AREA. IT THEN
C WRITES AND EDITED MED-X TAPE FOR THIS AREA WHERE EACH RECORD
C CONTAINS ALL THE INFORMATION FROM THE MED-X TAPE AND ALSO THE
C ZONE NUMBER AND UTM COORDINATES.
C
C THE USER CAN OPTIONALLY DEFINE PSEUDO ENUMERATION DISTRICTS FOR
C GROWTH SINCE THE LAST GENERAL CENSUS AND CAN ALSO OPTIONALLY
C DEFINE GENERAL AREAS OF GROWTH BY THE LOCATION COORDINATES OF
C EACH RECTANGLE AND THE POPULATION COUNT AND HOUSING COUNT
C COEFFICIENTS RESPECTIVELY.
C
C SEE THE CAASE USER'S MANUAL (COMPUTER ASSISTED AREA SOURCE
C GRIDING PROCEDURE (CAASE) USER'S MANUAL, EPA-450/3-74-035
C AS REVISED) FOR A COMPLETE DESCRIPTION OF INPUT, OUTPUT, AND
C RUNNING INSTRUCTIONS.
C
C*** THESE DIMENSIONS ASSUME NO MORE THAN 30 COUNTIES FROM ANY ONE
C STATE IN THE STUDY AREA, NO MORE THAN 100 PSEUDO (NEW) ENUMERATION
C DISTRICTS IN THE STUDY AREA AND NO MORE THAN 100 RECTANGLES OF
C GROWTH (POSITIVE OR NEGATIVE) IN THE STUDY AREA.
C
C DIMENSION MURDS(5259)
C DIMENSION XDATA(25), ICNTY(30), CNTY(5,30), AQCR(5), IREC(30), STA00002500
C ILE(5), X(100), Y(100), XL(100), YL(100), JZON(100), HCOEF(100), PC00002600
C ZUEF(100), XRH(100), YTP(100), XX(100), YY(100), KZON(100), ISTAT(100002700
C 300), KOUNTY(100), HCOUNT(100), PCOUNT(100)
C KALAB XLAT,XLONG,XXLAT,XXLONG,FMINOR,FMEAS
C KALAB DYOUT,DXOUT
C
C ASSIGN READER UNIT NUMBER
C IREAD=5
C
C ASSIGN PRINTER UNIT NUMBER
C IPRINT=6
C IREU=0

```

```

C
C      ASSIGN MED-X TAPE UNIT NUMBER
      ITAP1=7
C
C      ASSIGN CAASE1 OUTPUT UNIT NUMBER
      ITAP2=4
      ICNT=1
      INDI=4
      REWIND ITAP2
C
C***** READ FIRST MED-X BLOCK AND SPACE PAST HEADER BLOCK.
C
      CALL NTRAN (ITAP1,3,5236,WORDS,IOERR,22)
      IF (IOERR.LT.0) GO TO 730
      IOBLK=138
      IPTK=7
      ILENGW=5236
C
C*****READ INPUT CARD DATA, NUMBER OF STATES, STUDY AREA NAME, AND
C      PRIMARY UTM ZONE.
C
C*****CAUTION*****
C      STATES MUST BE REQUESTED IN THEIR ORDER ON THE MED-X TAPE.
C
      READ (IHEAD,10) NSTAT,AGCR,KZONE
      FORMAT (I4,5A4,I4)
      WRITE (IPRINT,20) AGCR,NSTAT,KZONE
      FORMAT ('1STUDY AREA IS ',5A4/6X,'NO. OF STATES INCLUDED IS ',I4,1
      0X,' PRIMARY UTM ZONE IS ',I4///)
C
C*****READ IN PROJECTED FACTORS TO BE APPLIED TO ENUMERATION
C      DISTRICT POPULATION (RECTANGLES OF GROWTH)
C
      READ (IHEAD,30) IGROTH,IEDS
      FORMAT (2I5)
C
C      IGROTH--GROWTH FACTORS? YES=1, NO=0

```

```

00003800
00003900
00004000
00004100
00004200
00004300
00004400
00004500
00004600
00004700
00004800
00004900
00005000
00005100
00005200
00005300
00005400
00005500
00005600
00005700
00005800
00005900
00006000
00006100
00006200
00006300
00006400
00006500
00006600
00006700
00006800
00006900
00007000
00007100
00007200
00007300
00007400

```

```

40      IF (IGNOTH.EQ.0) GO TO 150
        WRITE (IPRINT,40)
        FORMAT (///, ' * * * * * UTM(KM) * * * * * UTM',13X, ' * *
100EFFICIENT ***'/5X, 'X',9X, 'Y',6X, 'X LENGTH Y LENGTH ZONE ',
200USING POPULATION'//)
        DO 130 JJ=1,100
          READ (IREAD,50) X(JJ),Y(JJ),XL(JJ),YL(JJ),JZON(JJ),HCOEF(JJ),PCOEF
1(JJ)
          FORMAT (4F10.0,15,2F10.0)
50      LAST CARD TEST
        IF (X(JJ).NE.0.) GO TO 70
        IPRUJ=JJ-1
        WRITE (IPRINT,60) IPROJ
60      FORMAT ('0', ' NUMBER OF RECTANGLES OF GROWTH = ',I4)
        GO TO 150
70      WRITE (IPRINT,50) X(JJ),Y(JJ),XL(JJ),YL(JJ),JZON(JJ),HCOEF(JJ),PCO
1EF(JJ)
        C
C*****PLACE RECTANGLES OF GROWTH INTO PROPER ZONE
        C
        C ALREADY PRIMARY ZONE ?
        IF (JZON(JJ).EQ.KZONE) GO TO 120
        C
        C DETERMINE DIRECTION OF CONVERSION
        IF (JZON(JJ).GT.KZONE) GO TO 80
        EW=1.0
        GO TO 90
80      EW=0.0
90      IBAD=0
        DXOUT=X(JJ)
        DYOUT=Y(JJ)
        CALL GICH (DYOUT,DXOUT,EW,IBAD)
        IF (IBAD.EQ.0) GO TO 110
        WRITE (IPRINT,100) Y(JJ),X(JJ)
100      FORMAT (///, ' ERROR IN PLACING RECTANGLE OF GROWTH INTO PROPER UTM
1 ZONE, Y, X = ',2F15.2)

```


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```

220 1 STORAGE ALLOCATED'//)
C CONTINUE
C
C INITIALIZE FILE COUNTER
C IEND=0
C
C*** READ IN STATE NAME AND FIPS CODE AND NUMBER OF COUNTIES IN THE
C STATE AND THEIR FIPS CODE NUMBERS AND NAMES
C
C READ (IREAD,10) NCNTY,STATE,KSTATE
C READ (IREAD,230) (ICNTY(N), (CNTY(M,N),M=1,5),N=1,NCNTY)
C FORMAT (I4,5A4)
C WRITE (IPRINT,240) (ICNTY(N), (CNTY(M,N),M=1,5),N=1,NCNTY)
C FORMAT ('0',10X,I4,5A4)
C WRITE (IPRINT,250) STATE,NCNTY
C FORMAT ('0',5X,'THE STATE OF ',5A4,' HAS ',I4,' COUNTY(S)')
C
C*** SET COUNTERS FOR NUMBER OF ENUMERATION DISTRICTS PROCESSED FOR
C EACH COUNTY TO ZERO. (IREC)
C
C DO 260 K=1,NCNTY
C IREC(K)=0
C CONTINUE
C***SET CONSTANTS.
C I=1
C IWHR=1
C CONTINUE
C ILM=0
C WRITE (IPRINT,280) (CNTY(J,I),J=1,5)
C FORMAT ('//',5X,'COUNTY ',5A4)
C
C HAS THE FIRST RECORD OF A NEW COUNTY ALREADY BEEN READ WHILE
C PROCESSING ANOTHER COUNTY ?
C
C GO TO (290,330), IWHR
C
C***READ MED-X TAPE AND SELECT ALL ENUMERATION DISTRICTS THAT LIE IN

```

00014900
 00015000
 00015100
 00015200
 00015300
 00015400
 00015500
 00015600
 00015700
 00015800
 00015900
 00016000
 00016100
 00016200
 00016300
 00016400
 00016500
 00016600
 00016700
 00016800
 00016900
 00017000
 00017100
 00017200
 00017300
 00017400
 00017500
 00017600
 00017700
 00017800
 00017900
 00018000
 00018100
 00018200
 00018300
 00018400
 00018500

```

C THE REQUIRED COUNTIES.
C
290 IPTR=IPTR+23
    IF (ILENGW.LT.(IPTR+21)) CALL READIT (8290)
    IREQ=IREQ+1
    DECODE (IDHLK,300,WORDS(IPTR)) LSTATE,XDATA(1),JCNTY
    FORMAT (I2,A2,I3,21A4,A2,F7.0,F8.0,2J10)
    IF ((IREQ/5000*.5000).EQ.IREQ) PRINT 310, LSTATE,JCNTY,IREQ
310 FORMAT (' STATE,COUNTY,NUMBER ',5I10)
    IF (LSTATE.NE.KSTATE) GO TO 290
    DECODE (IDHLK,320,WORDS(IPTR)) (XDATA(L),L=2,23),XHOUS,XPOP,LONG,L
1A1
320 FORMAT (7X,21A4,A2,F7.0,F8.0,2J10)
C*****CONVERT INTEGER LAT/LONG TO FLOATING-POINT.
    XLONG=LONG
    XLAT=LAT
    XLONG=XLONG/10000.
    XLAT=XLAT/10000.
330 IF (JCNTY-ICNTY(1)) 290,340,630
C
C**** HAVE FOUND A COUNTY MATCH.
340 IF (MICH.EQ.1) GO TO 440
    MICH=1
C
C**** ADD NEW ENUMERATION DISTRICTS TO OUTPUT TAPE IF THERE ARE ANY
    FOR THIS COUNTY
C
    IF (LEDS.EQ.0) GO TO 440
    DO 430 L=1,NEWEDS
C
C COUNTY MATCH ?
    IF (KCOUNTY(L)-JCNTY) 430,350,430
C
C COORDINATES PRIMARY ZONE ?
350 IF (KZON(L).EQ.KZONE) GO TO 400
C
C DETERMINE DIRECTION OF CONVERSION

```

IF (KZONE(L).GT.KZONE) GO TO 360	00022300
EW=1.0	00022400
GO TO 370	00022500
360 EW=0.0	00022600
370 IAD=0	00022700
DXOUT=XX(L)	00022800
DYOUT=YY(L)	00022900
CALL GIGR (DYOUT,DXOUT,EW,IAD)	00023000
IF (IAD.EQ.0) GO TO 390	00023100
WRITE (IPRINT,380) YY(L),XX(L)	00023200
FORMAT (///,' ERROR IN PLACING NEW ENUMERATION DISTRICT IN PROPER	00023300
1UM ZONE, Y, X = ',2F15.2)	00023400
GO TO 720	00023500
390 XX(L)=DXOUT	00023600
YY(L)=DYOUT	00023700
400 CONTINUE	00023800
C	00023900
C**** WRITE GOOD PSEUDO ENUMERATION DISTRICT RECORD ON OUTPUT TAPE	00024000
C WITH DUMMY LATITUDE AND LONGITUDE FOR RECORD PADDING	00024100
C	00024200
XLONG=1.0E+10	00024300
XLAT=1.0E+10	00024400
C	00024500
C***** SET CODE INDICATING PSEUDO ENUMERATION DISTRICT RECORD	00024600
C	00024700
KODE=3	00024800
WRITE (ITAP2,410) ISTAT(L),KOUNTY(L),HCOUNT(L),PCOUNT(L),XLONG,XLAT	00024900
410 IF,KZONE,XX(L),YY(L),KODE	00025000
FORMAT (I2,2X,I4,86X,F7.0,F8.0,2D25.16,I5,2F15.2,I4)	00025100
WRITE (IPRINT,420) ISTAT(L),KOUNTY(L),HCOUNT(L),PCOUNT(L),XLONG,XLAT	00025200
420 IAT,KZONE,XX(L),YY(L),KODE	00025300
FORMAT ('0',I2,3X,I3,86X,F7.0,F8.0,/,3X,2D25.16,I5,2F15.2,I4,/,)	00025400
IREC(I)=IREC(I)+1	00025500
430 CONTINUE	00025600
C	00025700
C*** FINISHED WITH PSEUDO ED'S BEING ADDED.	00025800
C	00025900

```

C**** NOW PROCESS EXISTING ENUMERATION DISTRICTS, FIRST RECORD WAS
C      ALREADY READ AT STATEMENT 680
C
C      NOW FIND THE UTM COORDINATES FOR THIS DISTRICT AND ADD TO
C      AN OUTPUT TAPE.
C
C      IF LATITUDE AND LONGITUDE ARE ZERO, THEN THE RECORD IS A
C      SUMMARY RECORD, DON'T PROCESS IT.
C      IF (XLONG+XLAT.EQ.0.) GO TO 290
C      XLAT=XLAT*3.608
C
C      CONVERT COORDINATES OF LATITUDE AND LONGITUDE TO UTM
C      FOR CED009, WEST LONGITUDES ARE NEGATIVE, WE ARE ALWAYS DEALING
C      WITH WEST.
C      XLONG=-XLONG*3.608
C      CALL CED009 (XXLONG,XXLAT,IND1,MZON,FMMUR,FMEAS,MERR)
C      ANY NON-ZERO ERROR CODES RETURNED FROM CED009?
C      IF (MERR) 450,520,450
C      GO TO (460,480,500), MERR
C      WRITE (IPRINT,470) IND1
C      FORMAT (3X,'CALLED CED009 WITH IND1 GT 4 OR IND1 LT 0, IND1= ',13)
C      GO TO 720
C      WRITE (IPRINT,490) XLAT
C      FORMAT (3X,'LAT EXCEEDS 80 DEG, LAT= ',D25.16)
C      GO TO 720
C      WRITE (IPRINT,510) XLONG
C      FORMAT (3X,'ABS(LONG) GT 180 DEG, LONG= ',D25.16)
C      GO TO 720
C
C      CONVERT METERS TO KILOMETERS
C
C      XOUT=FMEAS/1000.
C      YOUT=FM40R/1000.
C
C****IS THIS DISTRICT LOCATED IN THE PRIMARY UTM ZONE
C      IF (MZON.EQ.KZONE) GO TO 570

```


C	00029700
C	00029800
C	00029900
	00030000
	00030100
	00030200
	00030300
	00030400
	00030500
	00030600
	00030700
	00030800
	00030900
550	00031000
	00031100
	00031200
	00031300
	00031400
	00031500
	00031600
	00031700
	00031800
	00031900
	00032000
	00032100
	00032200
	00032300
	00032400
	00032500
	00032600
	00032700
	00032800
	00032900
	00033000
	00033100
	00033200
	00033300

```

C      NEED TO CONVERT TO PRIMARY ZONE, DETERMINE EAST-WEST DIRECTION OF
C      CONVERSION
C      IF (MZON.GT.KZONE) GO TO 530
      EW=1.0
      GO TO 540
530    EW=0.0
540    IBAU=0
      DYOUT=YOUT
      DXOUT=XOUT
      CALL GTR (DYOUT,DXOUT,EW,IBAU)
      IF (IBAU.EQ.0) GO TO 560
      WRITE (IPRINT,550) YOUT,XOUT
550    FORMAT (//,' ERROR IN CONVERTING COORDINATES TO PRIMARY UTM ZONE,
      1 Y, X = ',2F15.2)
      GO TO 720
560    CONTINUE
      XOUT=DXOUT
      YOUT=DYOUT

C***** ARE THERE PROJECTED FACTORS FOR THIS ED, I.E., IS IT WITHIN A
C      RECTANGLE OF GROWTH.
C      (CHECK RECTANGLES OF GROWTH)
C
C      ANY RECTANGLES TO CHECK ?
570    IF (IGRTH.EQ.0) GO TO 590
      DU 580 M=1,IPROJ
C
C      CHECK RECTANGLE SIDES
      IF (X(M).GT.XOUT.OR.XRH(M).LT.XOUT) GO TO 580
      IF (Y(M).GT.YOUT.OR.YTP(M).LT.YOUT) GO TO 580
C
C      APPLY COEFFICIENTS
      XHUS=XHUS*HCUEF(M)
      XPOP=XPOP*PCUEF(M)
C
C      SET RECORD TYPE CODE TO INDICATE MODIFICATION MADE TO RECORD

```

```

00033400
00033500
00033600
00033700
00033800
00033900
00034000
00034100
00034200
00034300
00034400
00034500
00034600
00034700
00034800
00034900
00035000
00035100
00035200
00035300
00035400
00035500
00035600
00035700
00035800
00035900
00036000
00036100
00036200
00036300
00036400
00036500
00036600
00036700
00036800
00036900
00037000

580 KODE=2
      GO TO 600
      CONTINUE
C
C      NO HOUSING OR POPULATION MODIFICATION SET RECORD TYPE.
590 KODE=1
600 CONTINUE
C
C*****WRITE GOOD RECORD ON OUTPUT TAPE.
C
      WRITE (ITAP2,610) LSTATE,XDATA(1),JCNTY,(XDATA(L),L=2,23),XHOUS,XP
      1UP,XLONG,XLAT,KZONE,XOUT,YOUT,KODE
      FORMAT (I2,A2,I4,21A4,A2,F7.0,F8.0,2D25.16,I5,2F15.2,I4)
610
C
C***** THIS SECTION PRINTS THE FIRST 25 RECORDS (INCLUDING THE ADDED
C      ENUMERATION DISTRICTS) FOR EACH COUNTY.
C      CAN BE DELETED OR MODIFIED TO PRINT ALL RECORDS IF DESIRED.
C
      IREC(1)=IREC(I)+1
      IF (IREC(1).GT.25) GO TO 290
      WRITE (IPRINT,620) LSTATE,XDATA(1),JCNTY,(XDATA(L),L=2,23),XHOUS,X
      1UP,XLONG,XLAT,KZONE,XOUT,YOUT,KODE
      FORMAT ('0',I1,I2,A2,I3,21A4,A2,F7.0,F8.0,/,3X,2D25.16,I5,2F15.2,
      14,/)
620
      GO TO 290
C
C*****HAVE FOUND ALL ENUMERATIONS DISTRICTS FOR ONE COUNTY, LOOK FOR
C      ANOTHER COUNTY.
C
630 CONTINUE
      WRITE (IPRINT,640) (CNTY(J,I),J=1,5),KZONE
      FORMAT ('0',5X,'FOR COUNTY ',5A4,5X,' ZONE NO.',I10//)
640
C
C*****I HAVE TO BEGIN A NEW COUNTY, IF THERE IS ONE.
      IF (IEND.EQ.1) GO TO 660
      I=I+1
      IF (I-COUNTY) 650,650,660

```


10	WORDS(1)=WORDS(IPTR)	00040800
20	IPTR=IPTR+1	00040900
	CONTINUE	00041000
	IX=IX+1	00041100
	CALL NTRAN (ITAP1,3,5236,WORDS(1X),IOERR,22)	00041200
	NTRANC=NTRANC+1	00041300
	IF (IOERR.LT.0) GO TO 50	00041400
	ILENGW=5236+IX-1	00041500
	IF (WORDS(1).NE.TEST) GO TO 30	00041600
	IPTR=2	00041700
	RETURN	00041800
30	WRITE (IPRINT,40) WORDS(1),ILENGW,IPTR,NTRANC,WORDS	00041900
40	FORMAT ('INTRAN ERROR, WORD(1) = ',A6,' ILENGW =',I6,' IPTR =',I6,' IPTR =',I6,	00042000
	1, NTRANC = ',I6,/,262(1X,20A6,/))	00042100
	STOP	00042200
50	IF (IOERR.EQ.-2.AND.IFCNT.EQ.0) GO TO 70	00042300
	WRITE (IPRINT,60) IOERR,NTRANC	00042400
60	FORMAT ('I/O ERROR IN MED-X TAPE: ',I3,' NTRAN COUNT = ',I7)	00042500
	STOP	00042600
70	IFCNT=1	00042700
	NTRANC=0	00042800
	CALL NTRAN (10,22)	00042900
	IPTR=7	00043000
	RETURN 1	00043100
		00043200
		00043300
	END	

C	SUBROUTINE CED009 (XLNG,XLAT,IND1,MZON,FMNOR,FMEAS,MERR)	00000100
C	MODIFIED BY HAWIS, RTI, 12/72 FOR ONLY 1 SPHEROID, I.E. WHERE IND2=200000200	00000200
C	GEODETIC POSITION TO UNIVERSAL TRANSVERSE MERCATOR COORDINATES	00000300
	DECH/COMPUTER CONCEPTS	00000400
	COMMON /CORD/ COORD	00000500
	REAL*8 COORD(16,7),FMPI	00000600
	REAL*8 DELTA,ALPHA,DELTAQ,DELTAI,BETA	00000700
	REAL*8 GAMMA,DDELTA,FTERM	00000800
	REAL*8 FIMLAT,FIMLNG,FILNG,FILAT,FMN,FMEAS	00000900
	REAL*8 FMNOR,XLNG,XLAT	00001000
	MERR=0	00001100
	IF (IND1) 10,10,20	00001200
	MERR=1	00001300
	RETURN	00001400
10		00001500
20	IF (IND1-5) 30,10,10	00001600
30	GO TO (40,50,60,70), IND1	00001700
40	FILNG=XLNG*78683.7792D0	00001800
	FILAT=XLAT*78683.7792D0	00001900
	GO TO 80	00002000
50	FILNG=XLNG*.38146972656D0	00002100
	FILAT=XLAT*.38146972656D0	00002200
	GO TO 80	00002300
60	FILNG=XLNG*2.062648062D0	00002400
	FILAT=XLAT*2.062648062D0	00002500
	GO TO 80	00002600
70	FILNG=XLNG	00002700
	FILAT=XLAT	00002800
80	IF (FILAT) 90,100,100	00002900
90	FIMLAT=-FILAT	00003000
	GO TO 110	00003100
100	FIMLAT=FILAT	00003200
110	CONTINUE	00003300
	IF (FIMLAT-2.88D10) 130,130,120	00003400
120	MERR=2	00003500
	RETURN	00003600
130	IF (FILNG) 140,150,150	00003700
140	FIMLNG=-FILNG	


```

150 GO TO 160
160 FIMLNG=FILNG
    CONTINUE
170 IF (FIMLNG-6.48D10) 190,180,170
    MERR=5
    RETURN
180 NZUN=1
    GO TO 200
190 MZON=(FILNG+6.696D10)/2.16D9
200 CONTINUE
    IF (FIMLAT-72.D8) 260,270,210
    CONTINUE
210 IF (FIMLAT-144.D8) 270,280,220
    CONTINUE
220 IF (FIMLAT-198.D8) 280,290,230
    CONTINUE
230 IF (FIMLAT-234.D8) 290,300,240
    CONTINUE
240 IF (FIMLAT-262.8D8) 300,310,250
    CONTINUE
250 IF (FIMLAT-277.2D8) 310,320,320
    J=1
    FMPHI=360.D7
260 GO TO 330
    J=2
    FMPHI=108.D8
270 GO TO 330
    J=3
    FMPHI=180.D8
280 GO TO 330
    J=4
    FMPHI=216.D8
290 GO TO 330
    J=5
    FMPHI=252.D8
300 GO TO 330
    J=6
310

```

```

00003800
00003900
00004000
00004100
00004200
00004300
00004400
00004500
00004600
00004700
00004800
00004900
00005000
00005100
00005200
00005300
00005400
00005500
00005600
00005700
00005800
00005900
00006000
00006100
00006200
00006300
00006400
00006500
00006600
00006700
00006800
00006900
00007000
00007100
00007200
00007300
00007400

```

320	FMPHI=270,DB	00007500
	GU TO 330	00007600
	J=7	00007700
	FMPHI=282.6DB	00007800
330	DELTA=(FIMLAT-FMPHI)*.00001D0	00007900
	I=6	00008000
	ALPHA=COORD(7,J)+COORD(8,J)*DELTA	00008100
340	ALPHA=COORD(I,J)+ALPHA*DELTA	00008200
	I=I-1	00008300
	IF (I) 350,350,340	00008400
350	DELTAQ=DELTA*ALPHA	00008500
	FTERM=MZON-31	00008600
	DELTA=(216.D7*FTERM+108.D7)-FILNG	00008700
	DELTA=DELTA*4848136811.D-20	00008800
	ALPHA=COORD(15,J)+COORD(16,J)*DELTAQ	00008900
	BETA=COORD(16,J)*DELTA	00009000
	I=14	00009100
360	GAMMA=COORD(I,J)+ALPHA*DELTAQ-BETA*DELTA	00009200
	DELTA=ALPHA*DELTA+BETA*DELTAQ	00009300
	ALPHA=COORD(I-1,J)+GAMMA*DELTAQ-DDELTA*DELTA	00009400
	BETA=GAMMA*DELTA+DDELTA*DELTAQ	00009500
	I=I-2	00009600
	IF (I-10) 370,370,360	00009700
370	GAMMA=COORD(10,J)+ALPHA*DELTAQ-DELTA*BETA	00009800
	DELTA=ALPHA*DELTA+BETA*DELTAQ	00009900
	FMIN=COORD(9,J)+GAMMA*DELTAQ-DDELTA*DELTA	00010000
	FMEAS=5.0D5-(GAMMA*DELTA+DDELTA*DELTAQ)	00010100
	IF (XLAT) 380,390,390	00010200
380	FMINUR=1.0D7-FMIN	00010300
	GU TO 400	00010400
390	FMINUR=FMIN	00010500
400	RETURN	00010600
C		00010700
	END	00010800

```

BLOCK DATA
COMMON /CORD/ CUORD
REAL*8 CORD(16,7)
REAL*8 CORD12(16),CORD22(16),CORD42(16),CORD52(16),CORD00000400
162(16),CORD72(16)
EQUIVALENCE (CUORD(1,1),CORD12(1)), (CUORD(1,2),CORD22(1)), (CUORD00000600
1(1,3),CORD32(1)), (CUORD(1,4),CORD42(1)), (CUORD(1,5),CORD52(1)), 00000700
2(CUORD(1,6),CORD62(1)), (CUORD(1,7),CORD72(1))
DATA CORD12 /,4890603699D-05,.0211783470D-10,.0206094087D-15,.002100000900
1352799D-20,.0013344641D-25,.0002154192D-30,.00105121D-35,.00002100001000
29708D-40,1105343.1D00,.6279435439D07,-.0545206260D07,-.0990165054D00001100
30/,.0221578063D07,.0222595275D07,-.0086799370D07,-.0054352765D07/ 00001200
DATA CORD22 /,5569679060D-05,.0787424577D-10,.0366618535D-15,.010700001300
1351529D-20,.0043800764D-25,.0016151478D-30,.0006562645D-35,.00026200001400
227691D-40,3318605.326D0,.5526156860D07,-.1381539215D07,-.046404365600001500
30D7,.0406929868D07,-.0023737423D07,-.0091961450D07,.0037826746D07/00001600
4
DATA CORD32 /,7521184517D-05,.2184990662D-10,.1135593294D-15,.057600001800
1965638D-20,.0323544317D-25,.0186820832D-30,.0111283189D-35,.00676000001900
26710D-40,5538411.779D0,.4106355473D07,-.1572825396D07,.0118047314D00002000
30/,.0195232064D07,-.0109480462D07,.0014859044D07,.0015131135D07/ 00002100
DATA CORD42 /,9679783520D-05,.4077989432D-10,.2659560366D-15,.183300002200
1896462D-20,.1361507835D-25,.1050208779D-30,.0833567868D-35,.06753300002300
24139D-40,6651204.6D0,.3195949863D07,-.1383886879D07,.0266102296D0700002400
3/,.0058104357D07,-.0067036894D07,.0025282671D07,-.0002169360D07/ 00002500
DATA CORD52 /,1416371196D-05,.9448163773D-10,.8939144732D-15,.929000002600
1952523D-20,1.0336559480D-25,1.1963321013D-30,1.4242120367D-35,1.7000002700
22308124042D-40,7765697.70D,.2187148430D07,-.1027623620D07,.0279208100002800
357D07,-.0025458841D07,-.0018513695D07,.0012562355D07,-.0004359447D00002900
407/ 00003000
DATA CORD62 /,1.8723215513D-05,1.6953882434D-10,2.1175151210D-15,2.00003100
19398158655D-20,4.3557493117D-25,6.7218060066D-30,10.6695415012D-3500003200
2,17.2886054901D-40,8323452.6D0,.1655376293D07,-.0799485147D07,.02300003300
38924408D07,-.0039827738D07,-.0003223536D07,.0005528952D07,-.00025200003400
423880D7/ 00003500
DATA CORD72 /2.4310955817D-05,2.8981418519D-10,4.6980991563D-15,8.00003600
15098855196D-20,16.4479412680D-25,33.1014282702D-30,68.532989309D-00003700

```

255,144.8462561026D-40,8714033.1D0,.1275252086D07,-.0624825325D07,.00003800
 30195643581D07,-.0039646076D07,.0002575786D07,.0002080265D07,-.000100003900
 425/142D07/
 00004000
 00004100
 00004200

C

END

```

SUBROUTINE GTGR (CN,CE,EW,IBAD)
C****THIS PROGRAM CONVERTS POINTS FROM ONE ZONE INTO ANOTHER ZONE.
C IF REQUIRES Y,X COORDINATES.
C NEEDS EW=0 GOING FROM EAST TO WEST. EW=1 GOING FROM WEST TO EAST.
C IBAD=1 INDICATES AN ERROR.
DIMENSION B1(8,8), NR(61)
REAL*8 U1,A1,RN,RE,CNP,CEP,A,B,C,U,CN,CE,V1
DEFINE FILE 8(61,768,L,IJK)
DATA NR /20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,
139,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,
261,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80/
CN=CN*1000.0
CE=CE*1000.0
A1=CN/100000.0
IN=A1+.5
RN=IN*100000
A1=CE/100000.0
IE=A1+.5
RE=IE*100000
CNP=(CN-RN)*.00001
CEP=(CE-RE)*.00001
DO 10 I=1,61
IF (NR(I).EQ.IN) GO TO 20
CONTINUE
IBAD=1
GO TO 60
10
IBLOCK=1
READ (8,IBLOCK) B1
IF (EW.EQ.1.) GO TO 30
IF (EW.EQ.0.) GO TO 40
IE=10-IE
GO TO 50
30
V1=-1.0
B1(IE,2)=B1(IE,2)*V1
B1(IE,4)=B1(IE,4)*V1
B1(IE,6)=B1(IE,6)*V1
B1(IE,8)=B1(IE,8)*V1
40

```

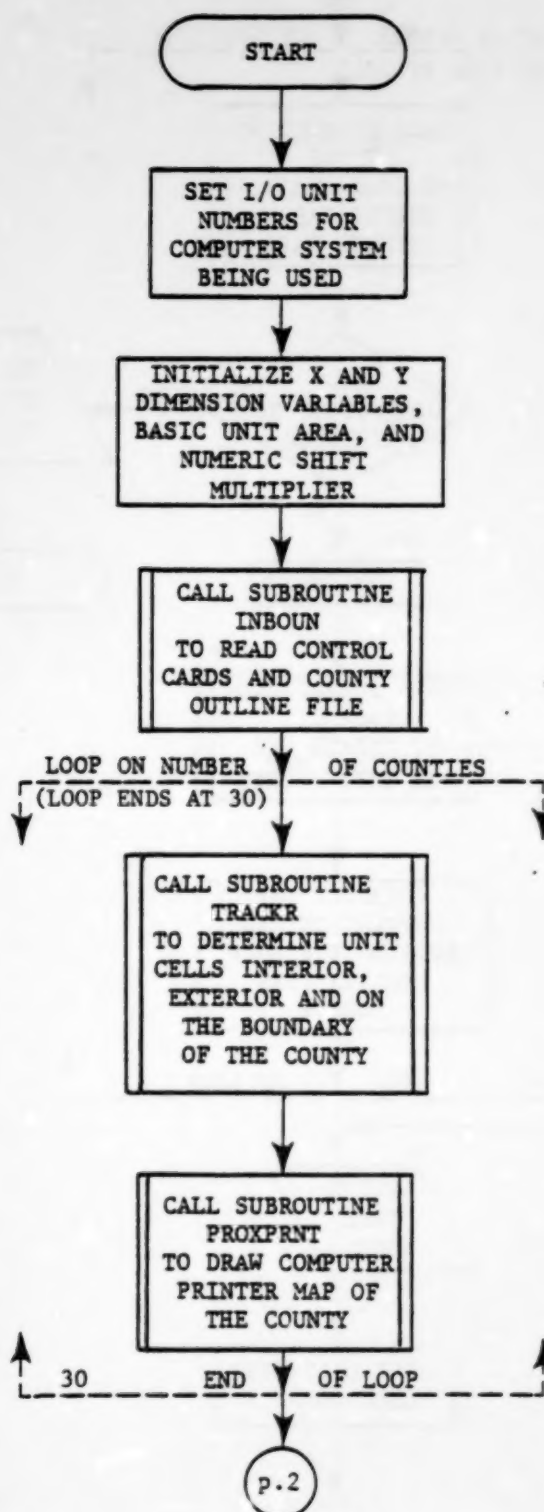

00003800
 00003900
 00004000
 00004100
 00004200
 00004300
 00004400
 00004500
 00004600
 00004700
 00004800

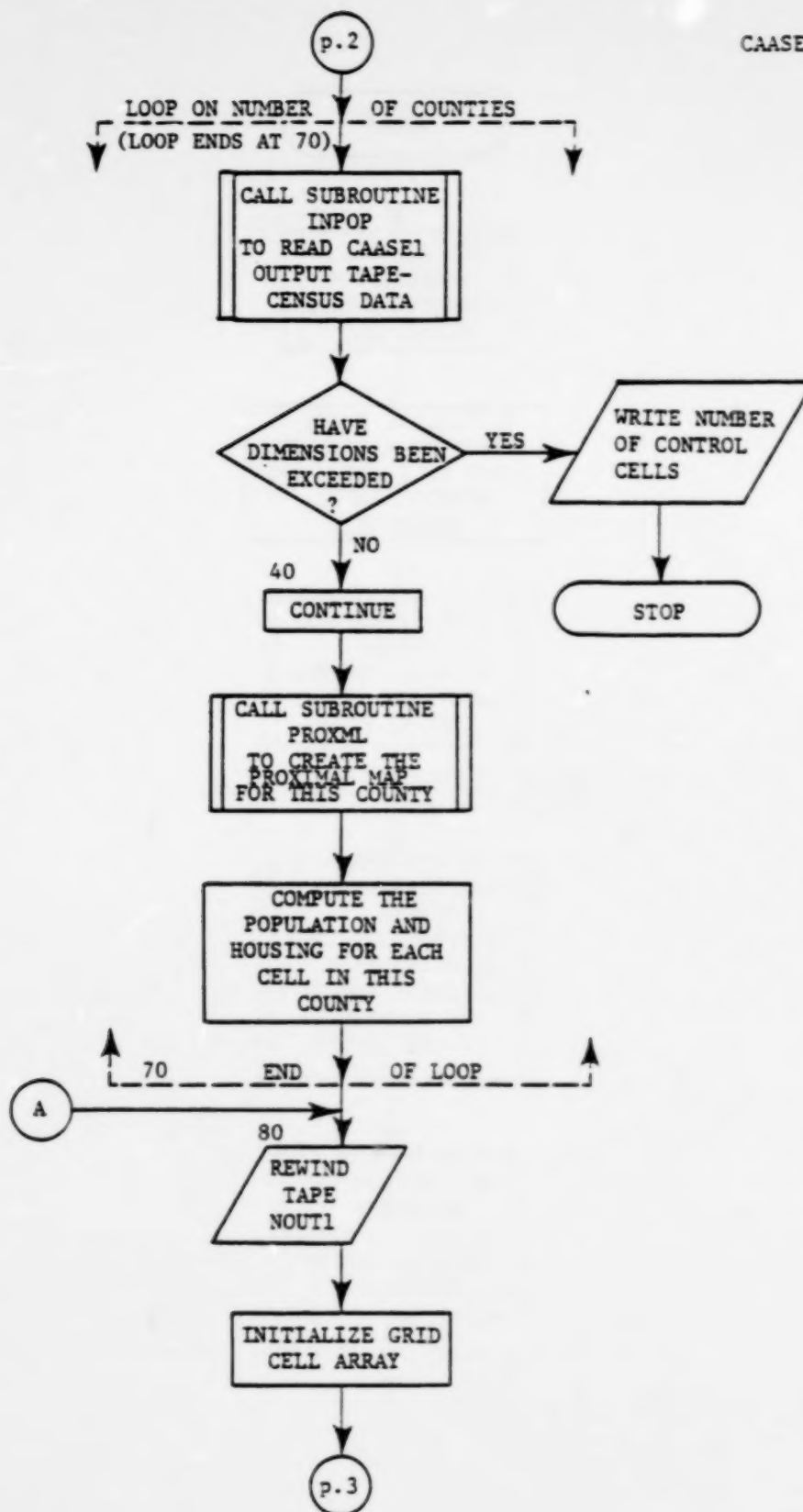
A=(B1(IE,5)+((CNP*B1(IE,7))-(CEP*B1(IE,8))))
 B=(U1(IE,6)+((CNP*B1(IE,8))+(CEP*B1(IE,7))))
 C=(B1(IE,3)+((CNP*A)-(CEP*B)))
 U=(B1(IE,4)+((CNP*B)+(CEP*A)))
 CN=(B1(IE,1)+((CNP*C)-(CEP*D)))
 CE=(50000.0+B1(IE,2)+((CNP*D)+(CEP*C)))
 CN=CN/1000.0
 CE=CE/1000.0
 RETURN
 END

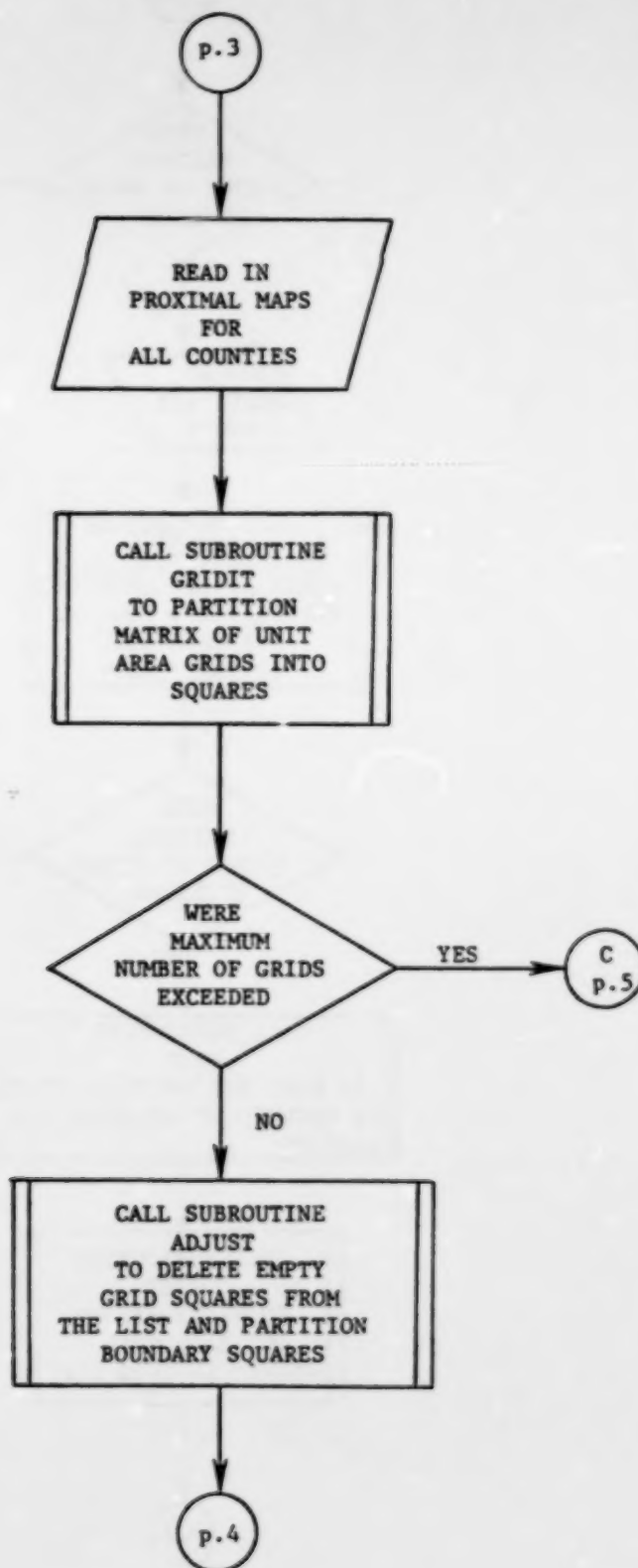
50
 60
 C

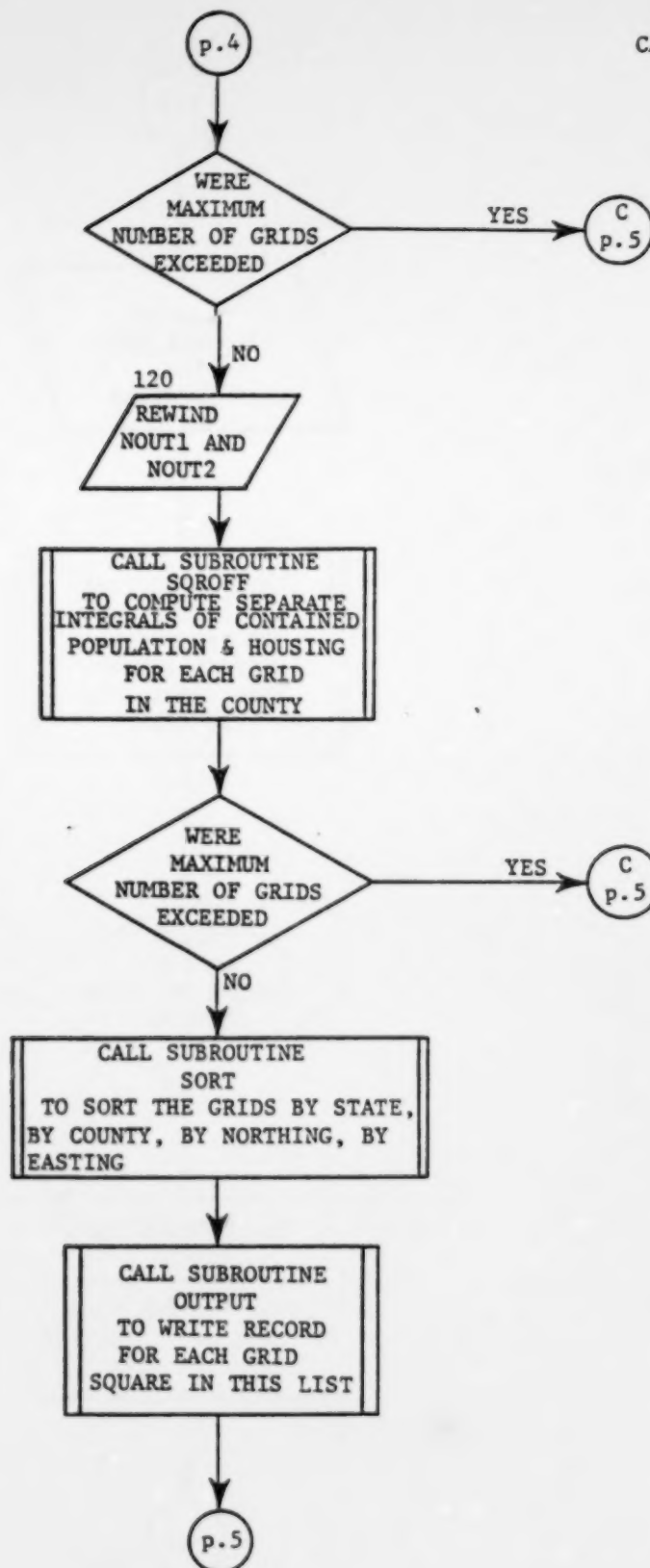
APPENDIX B

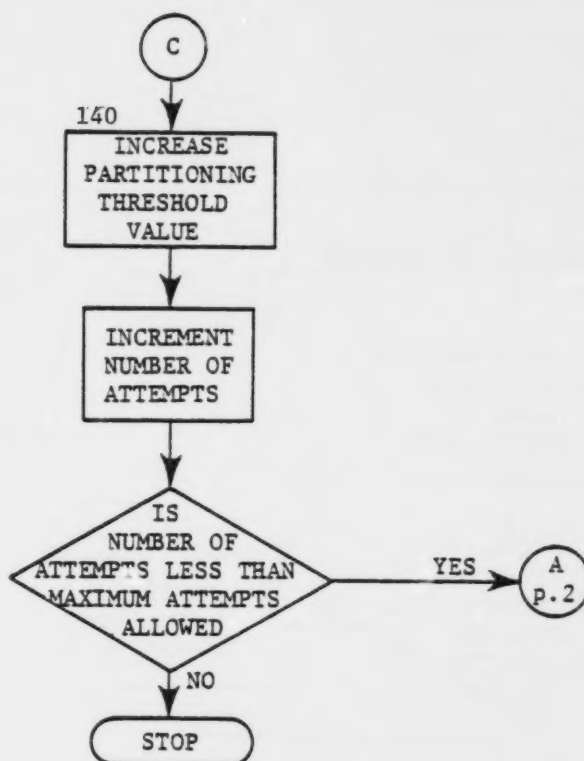
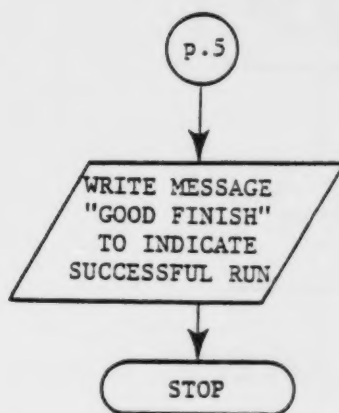
LOGICAL FLOWCHARTS AND FORTRAN SOURCE CODE LISTINGS
CAASE2 (and Subroutines)

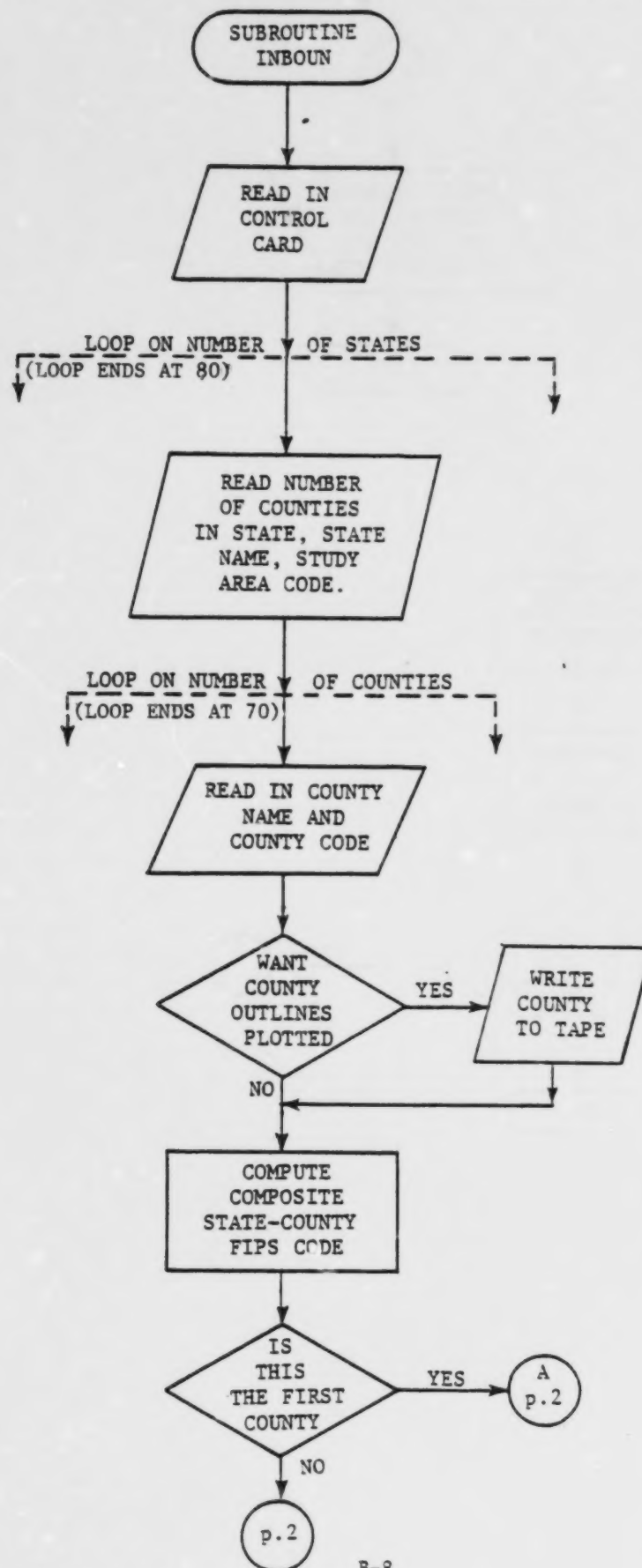


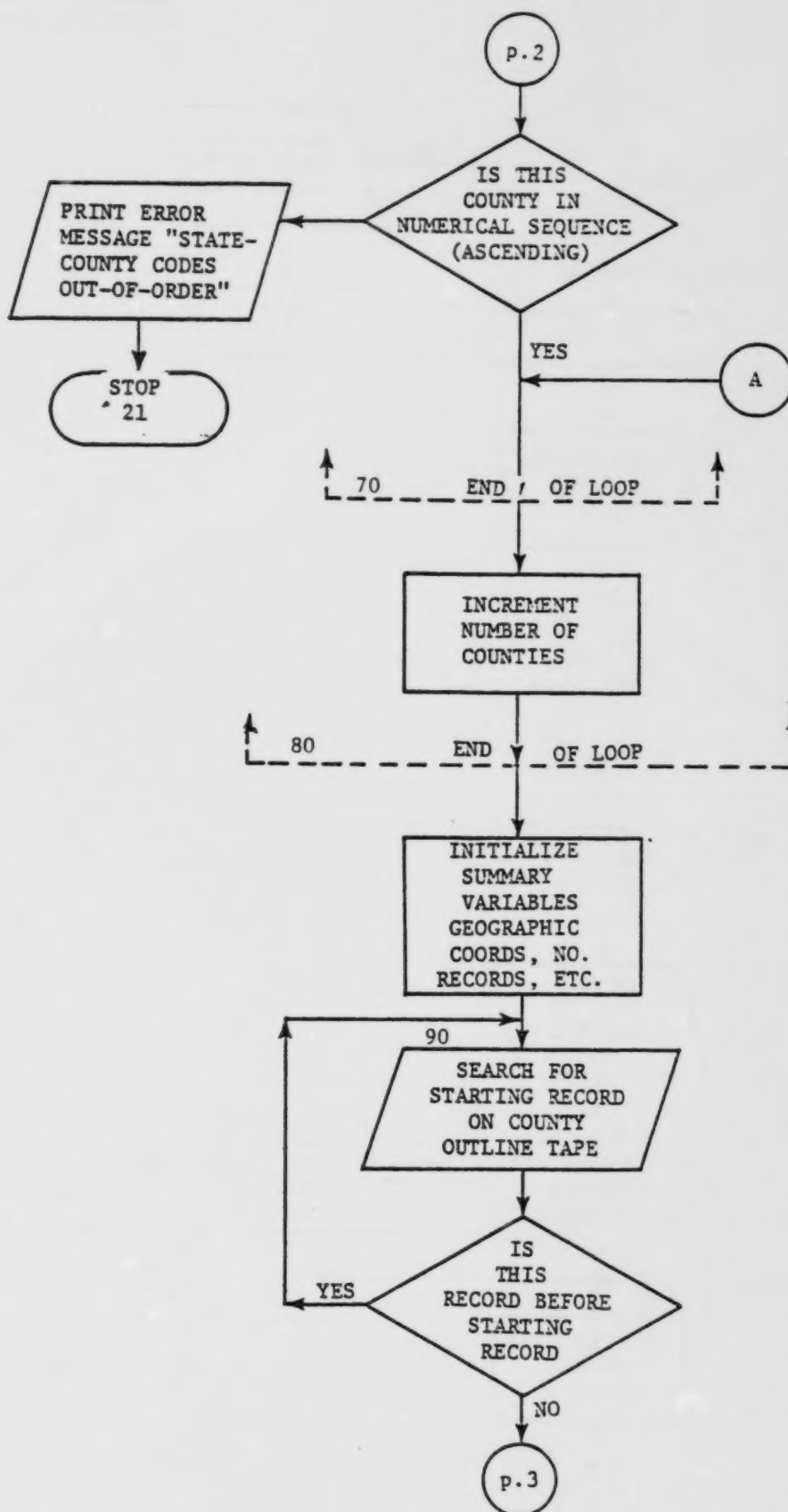


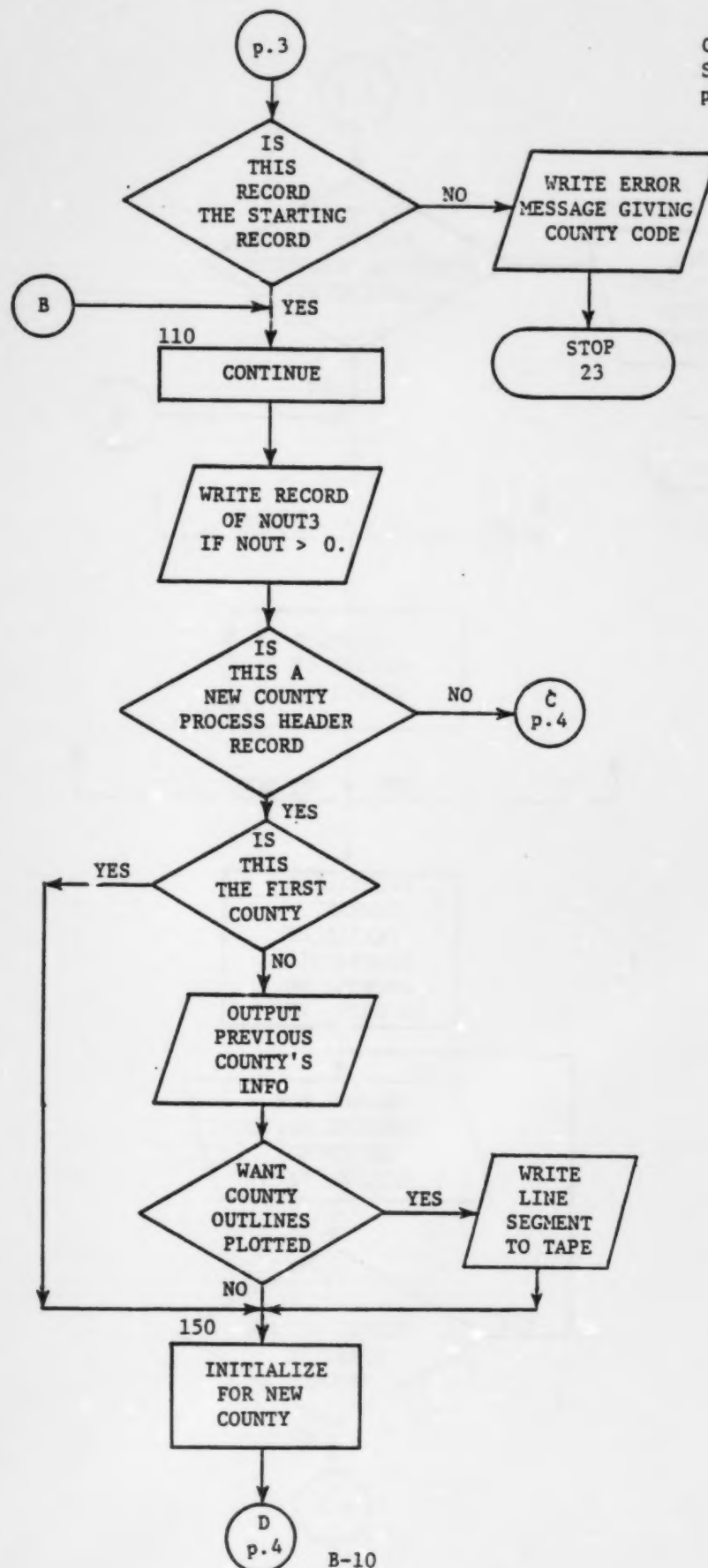


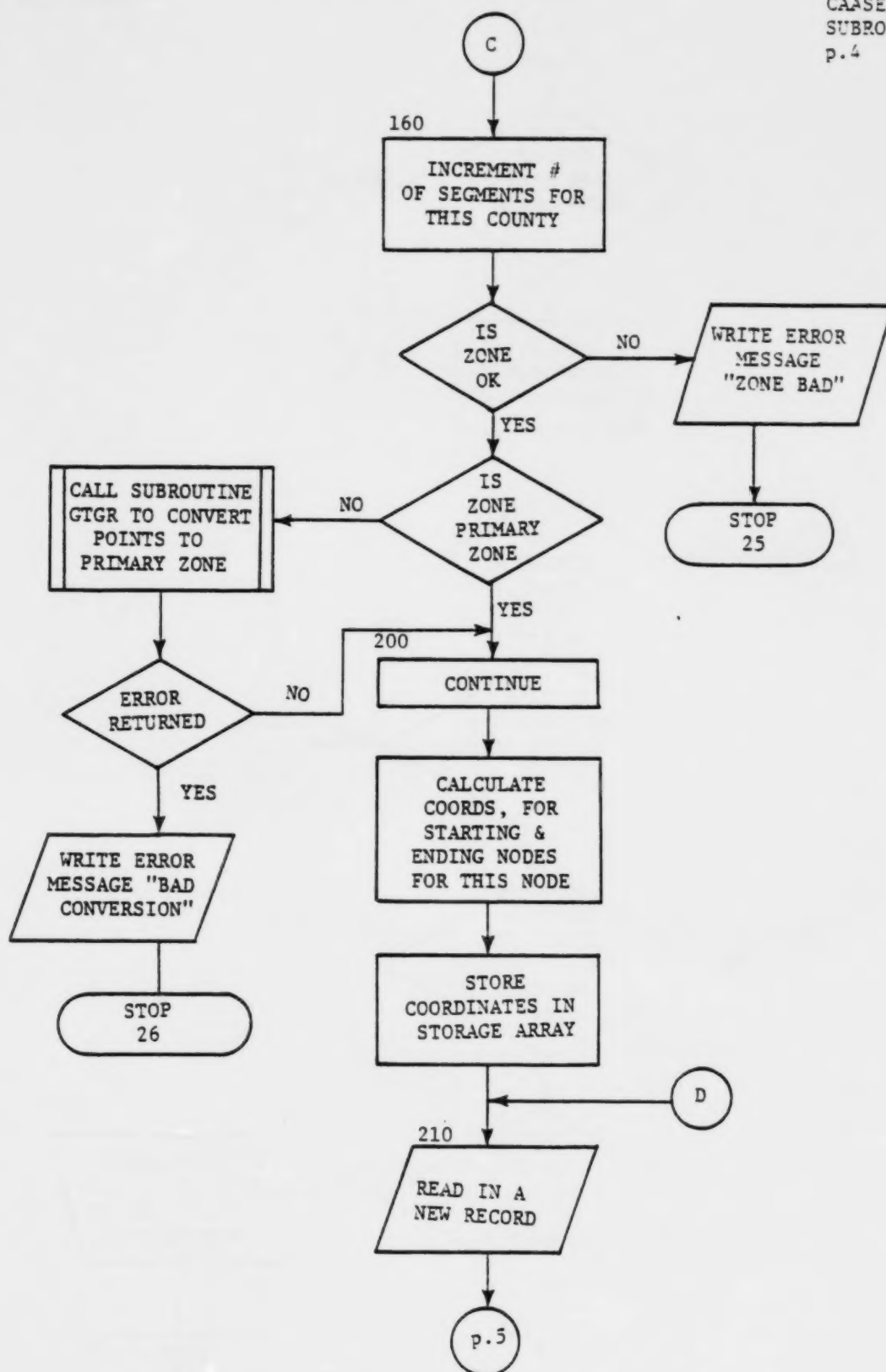


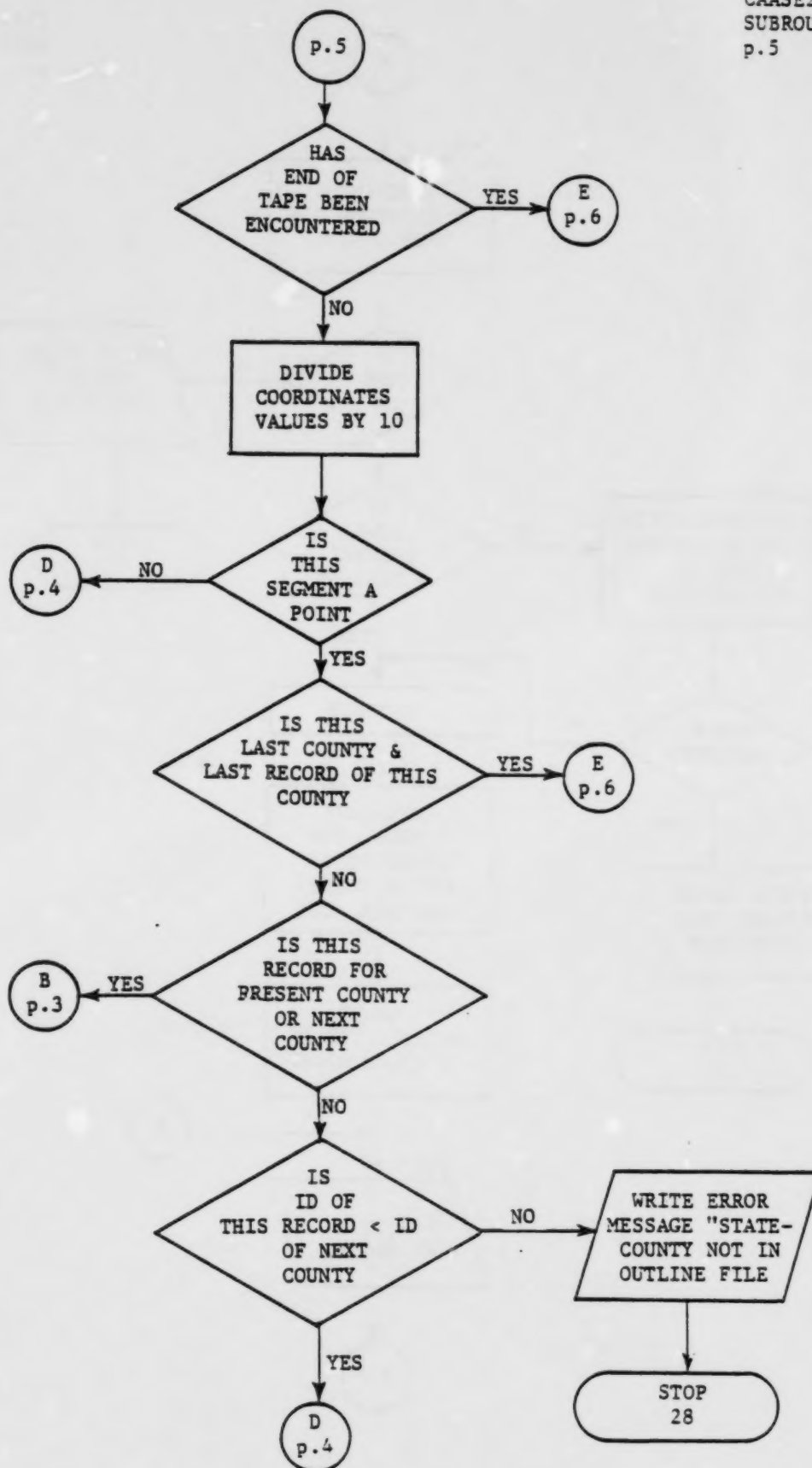


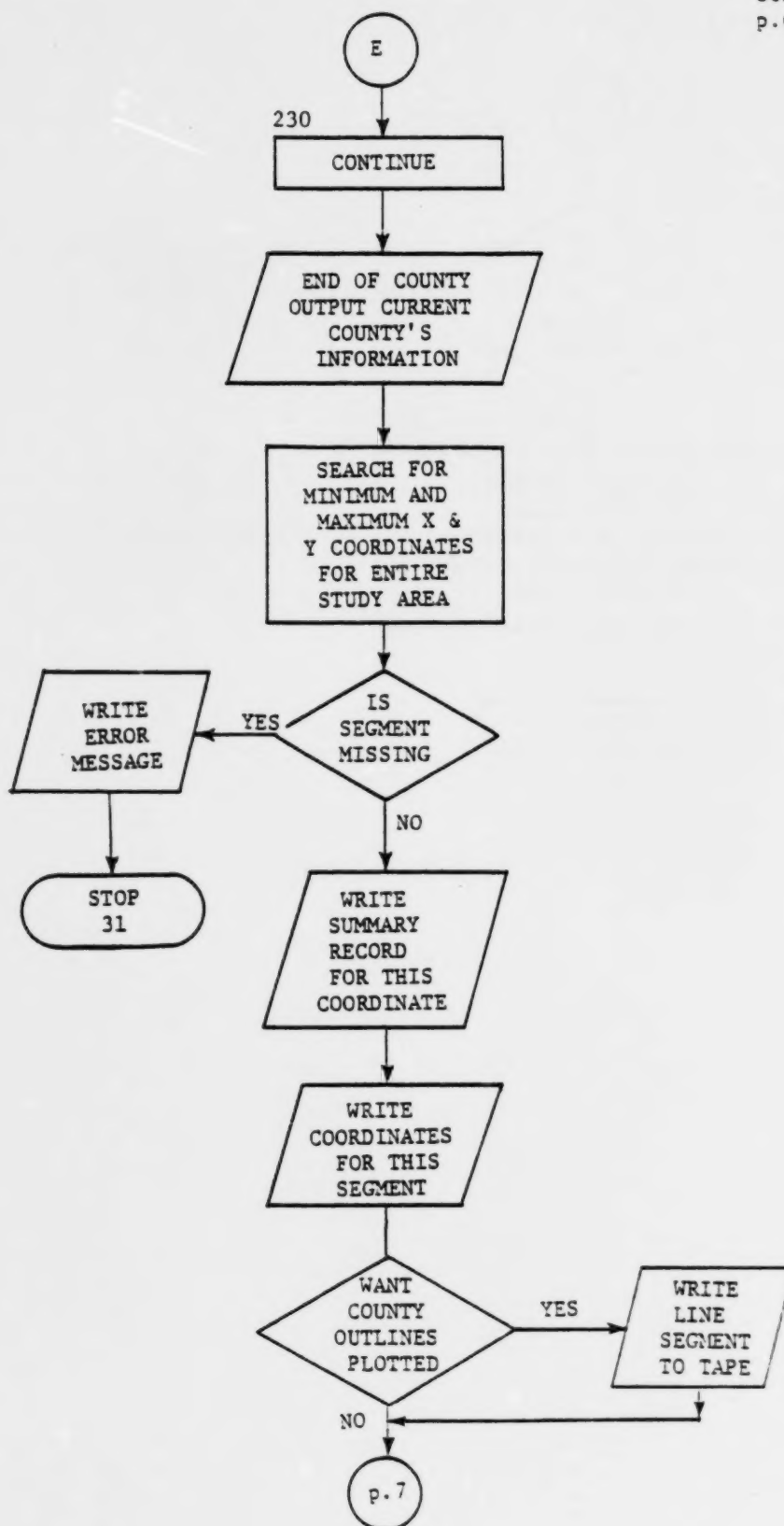


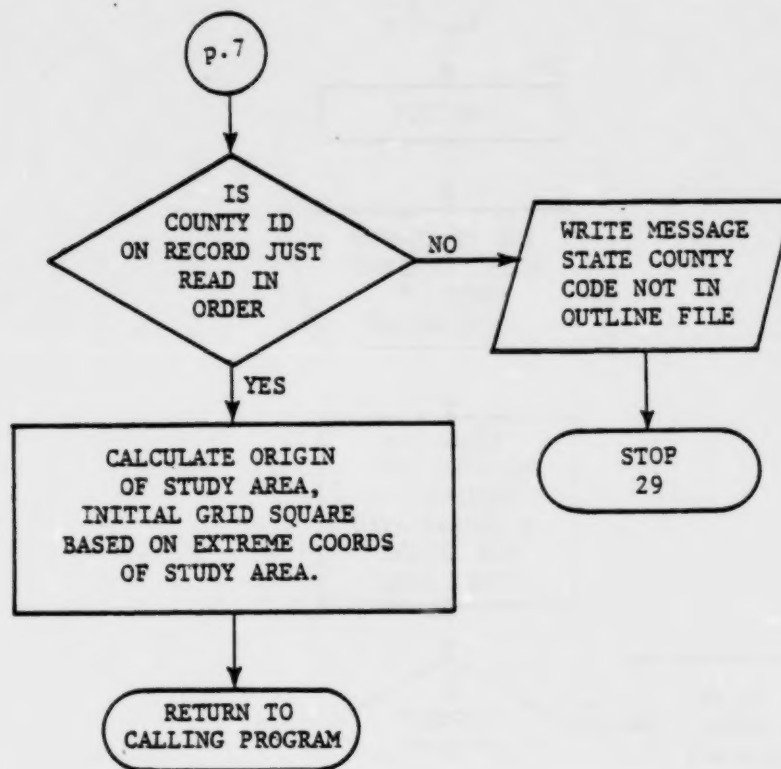


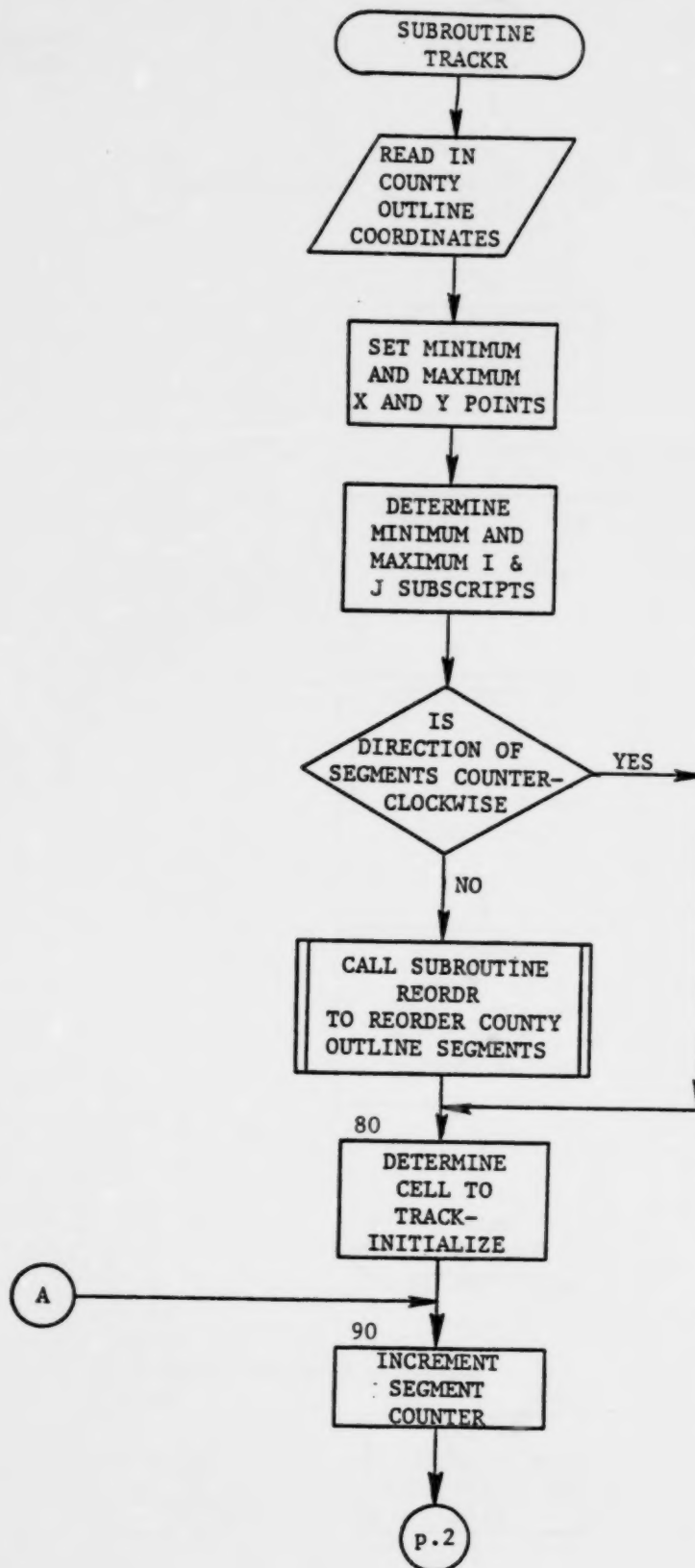


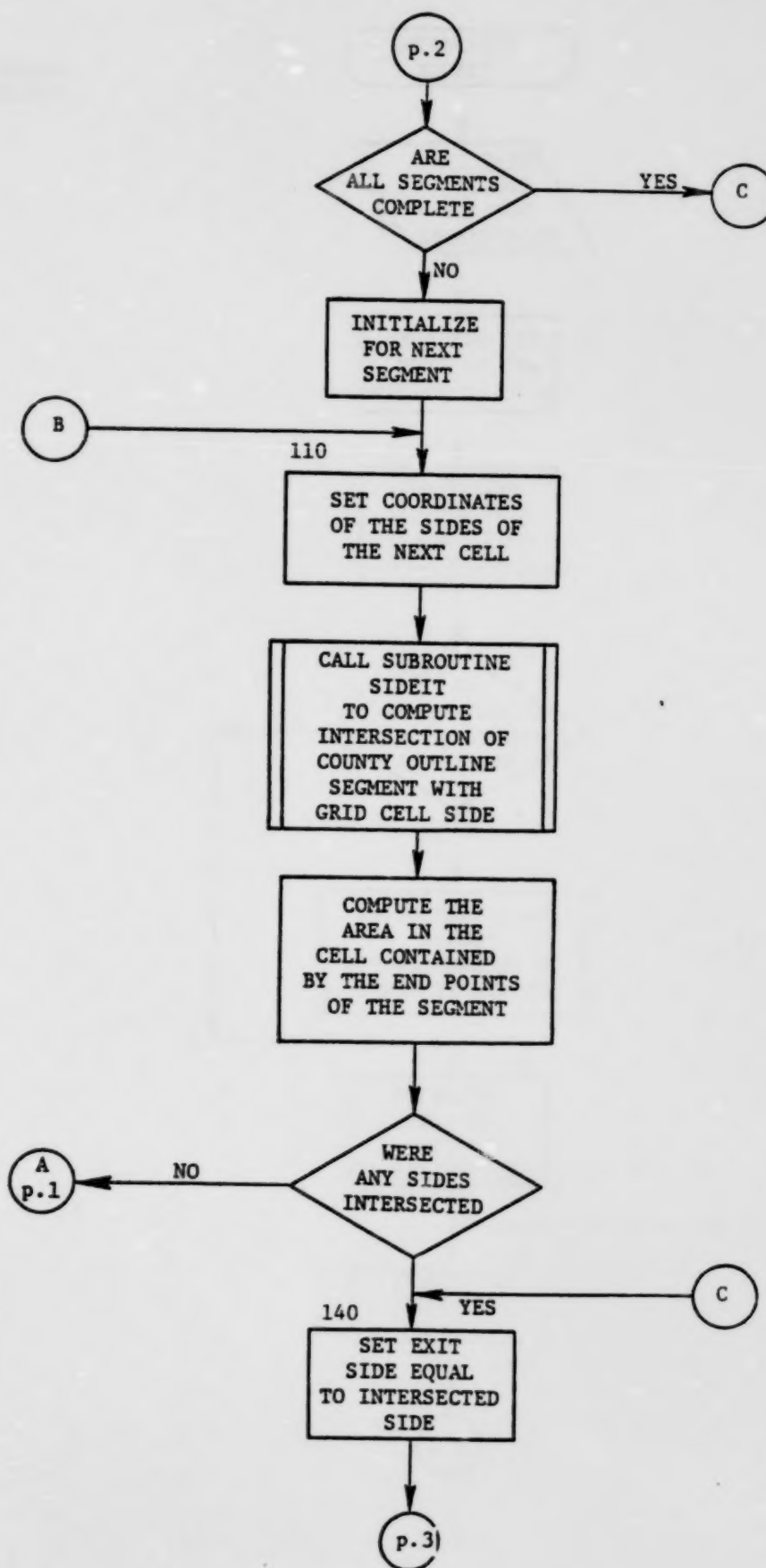


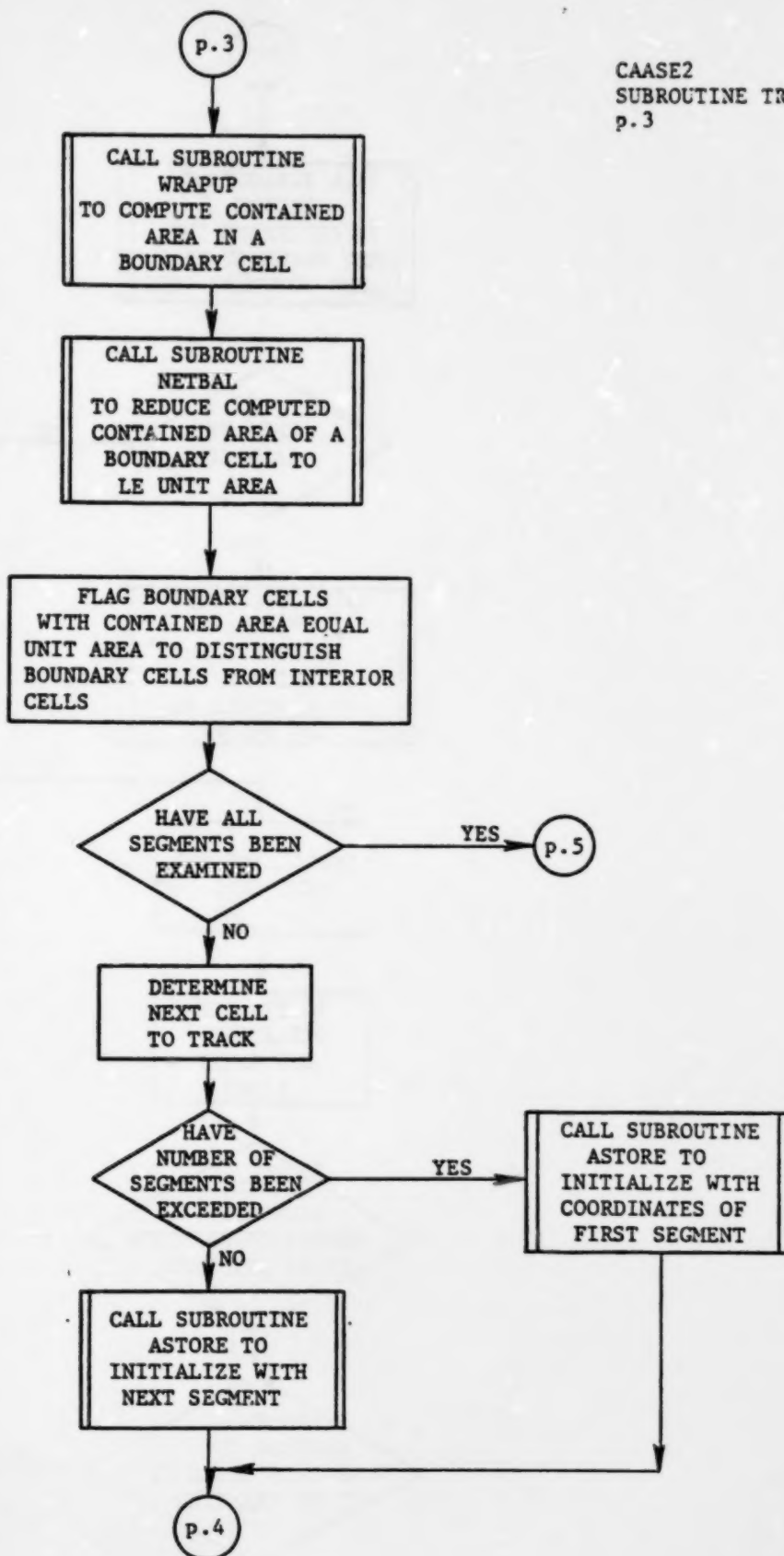


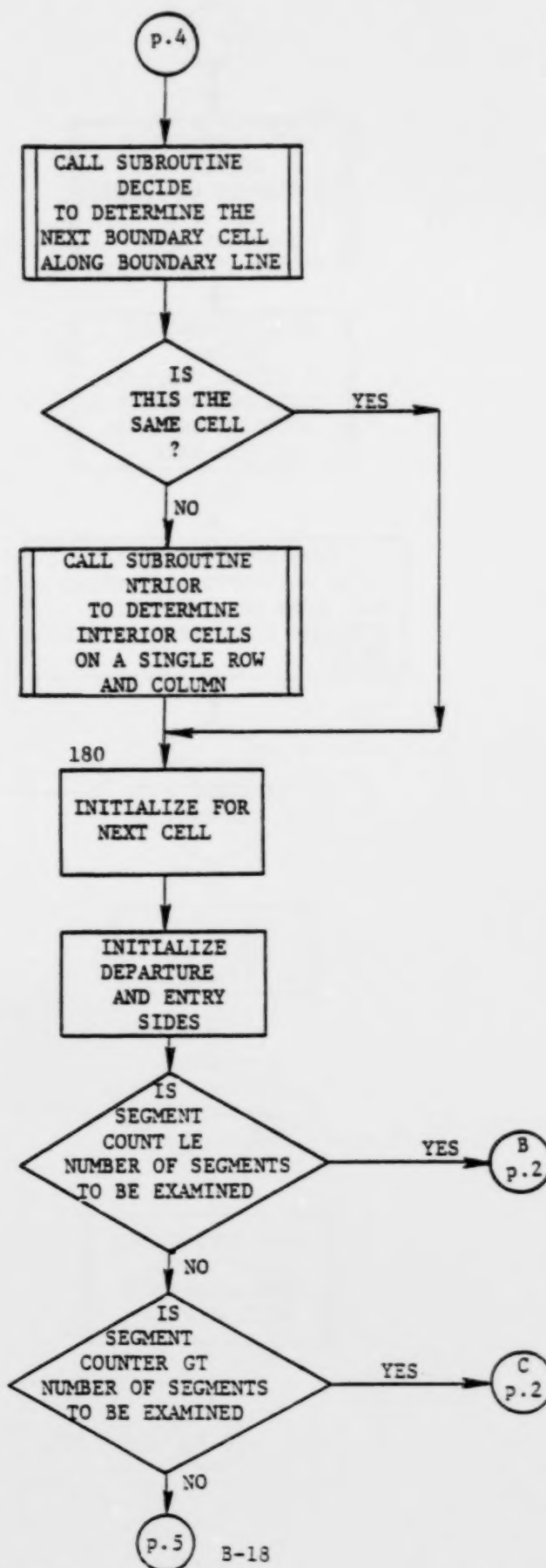


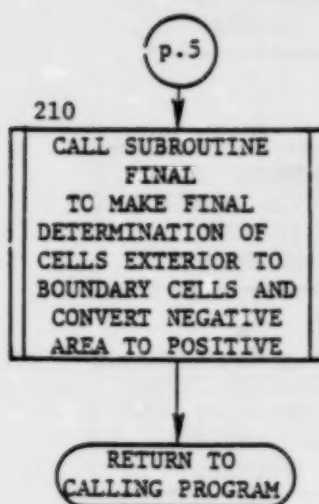


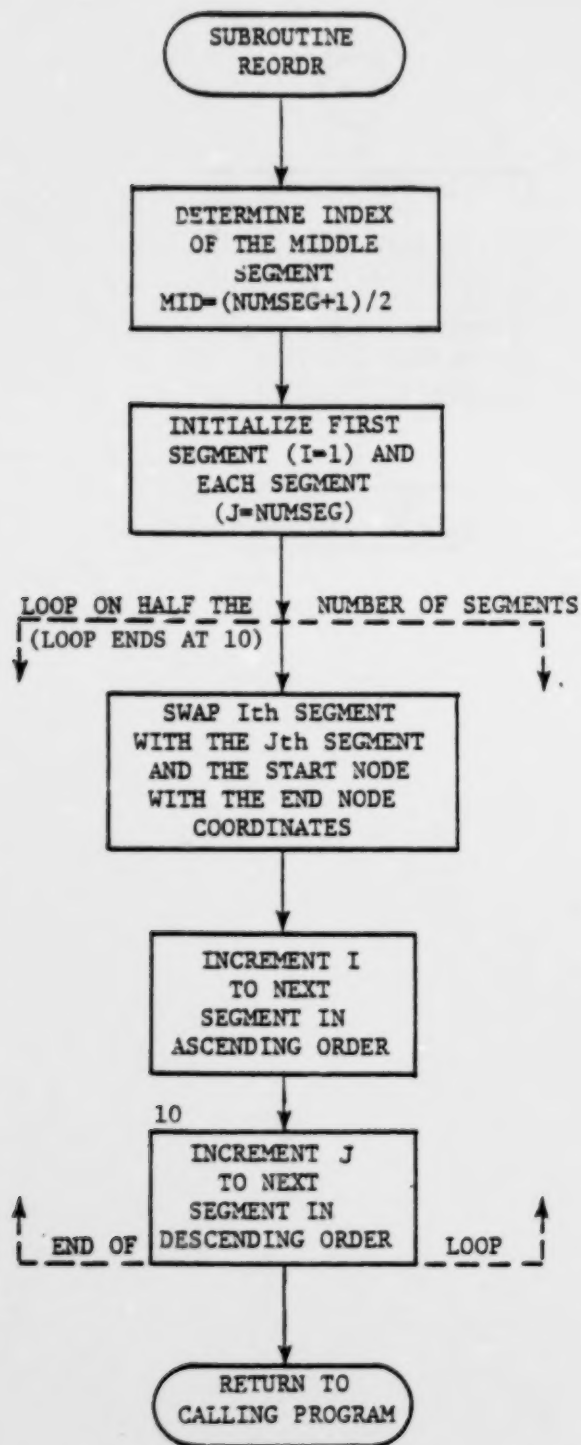


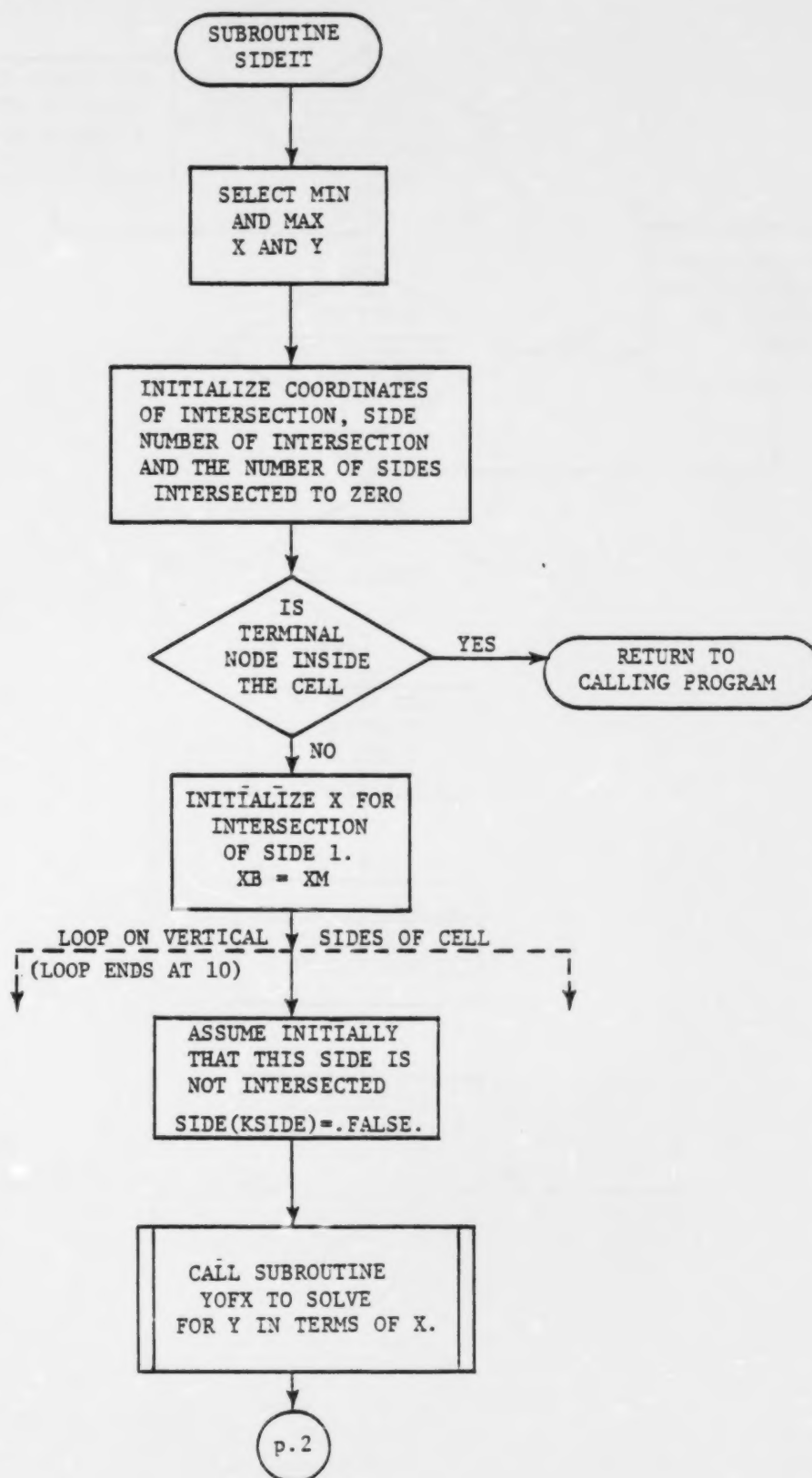


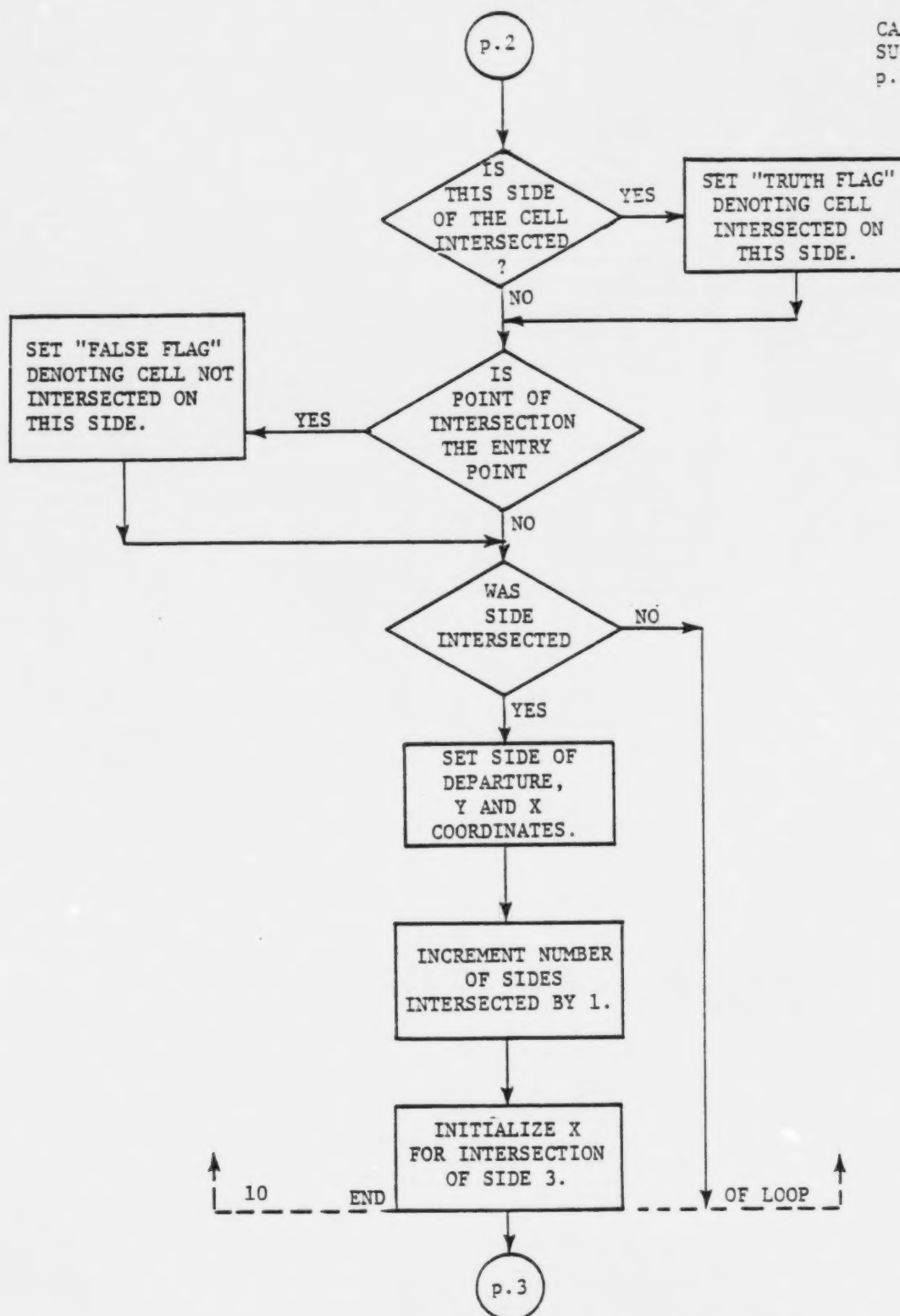


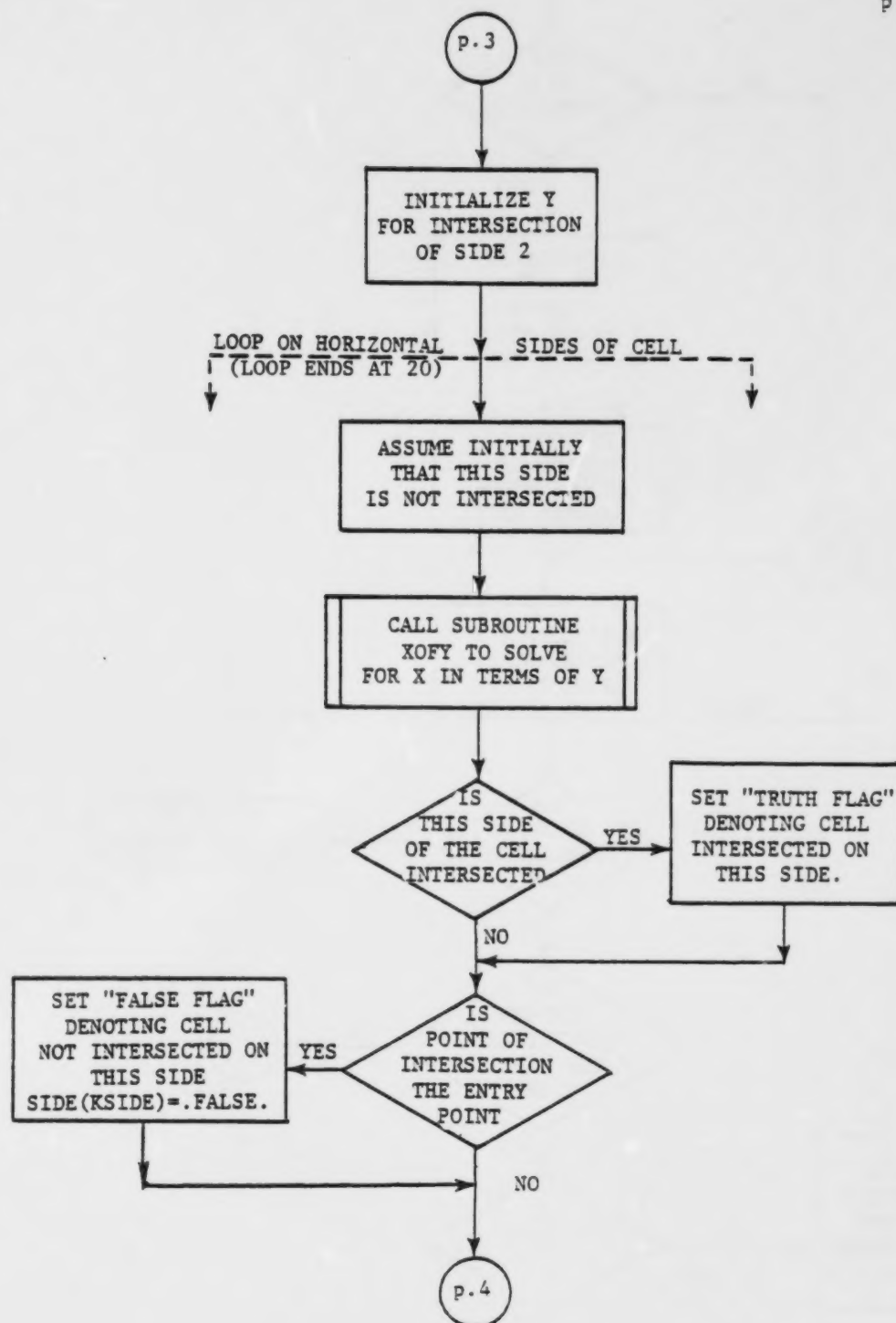


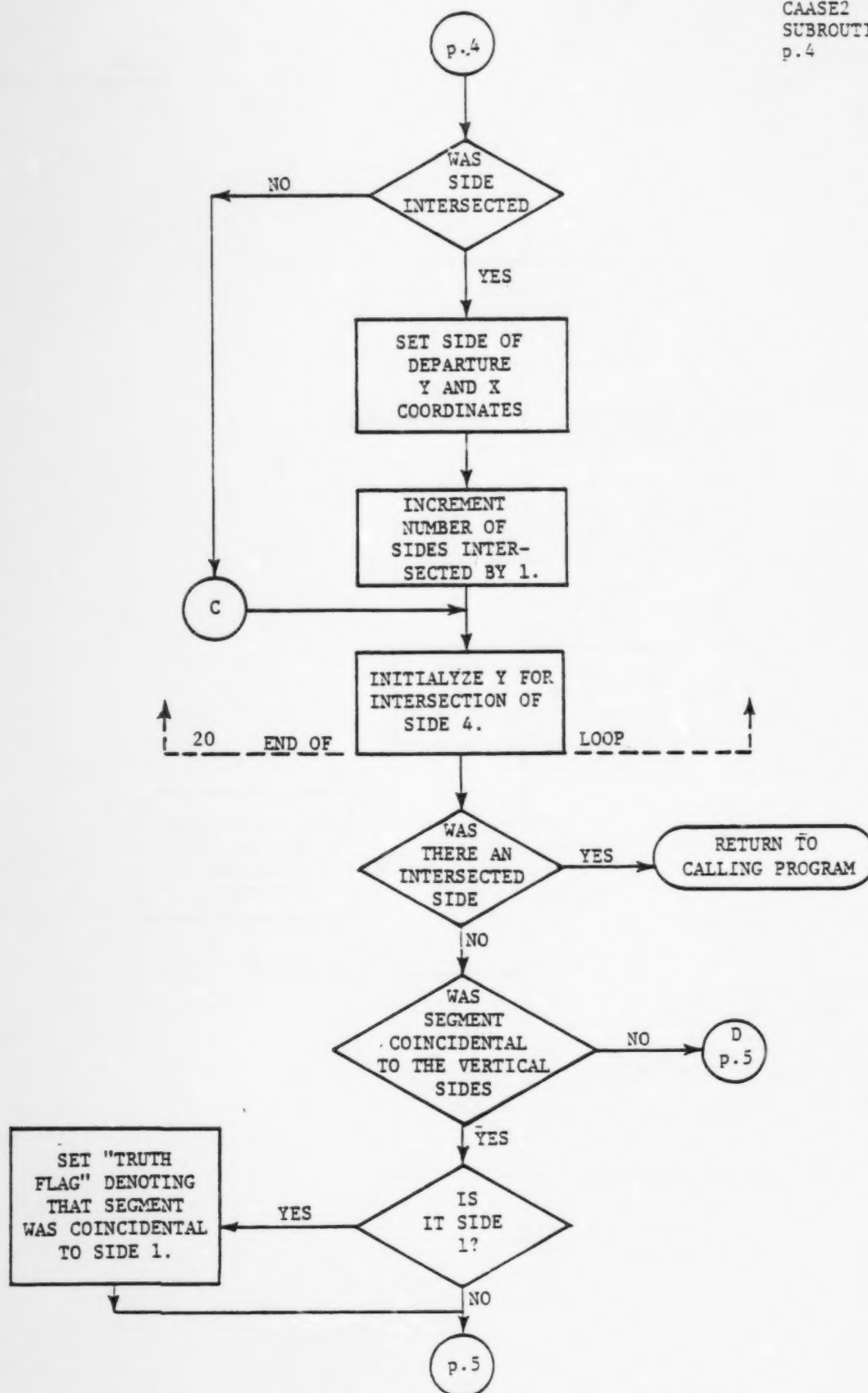


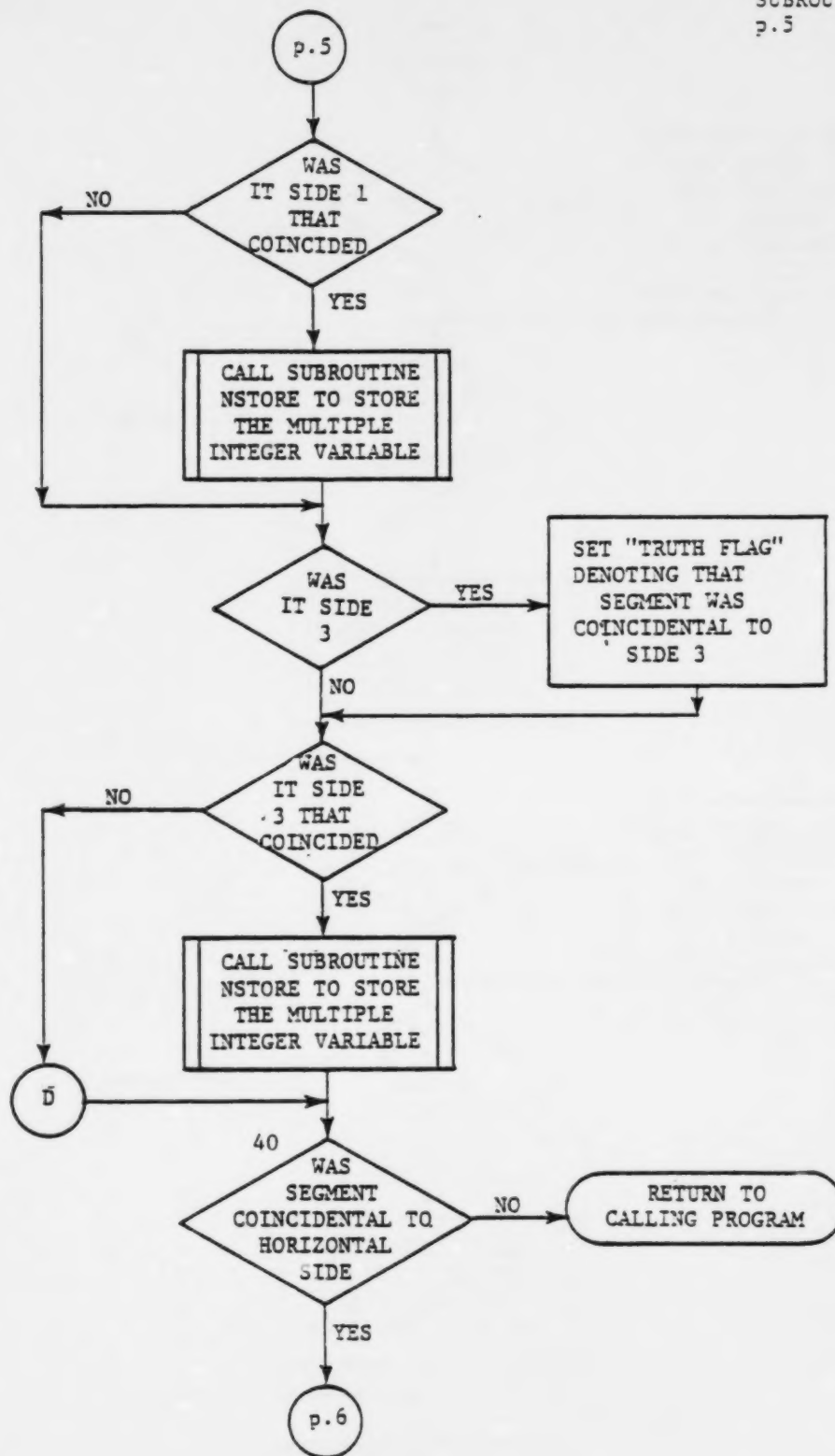


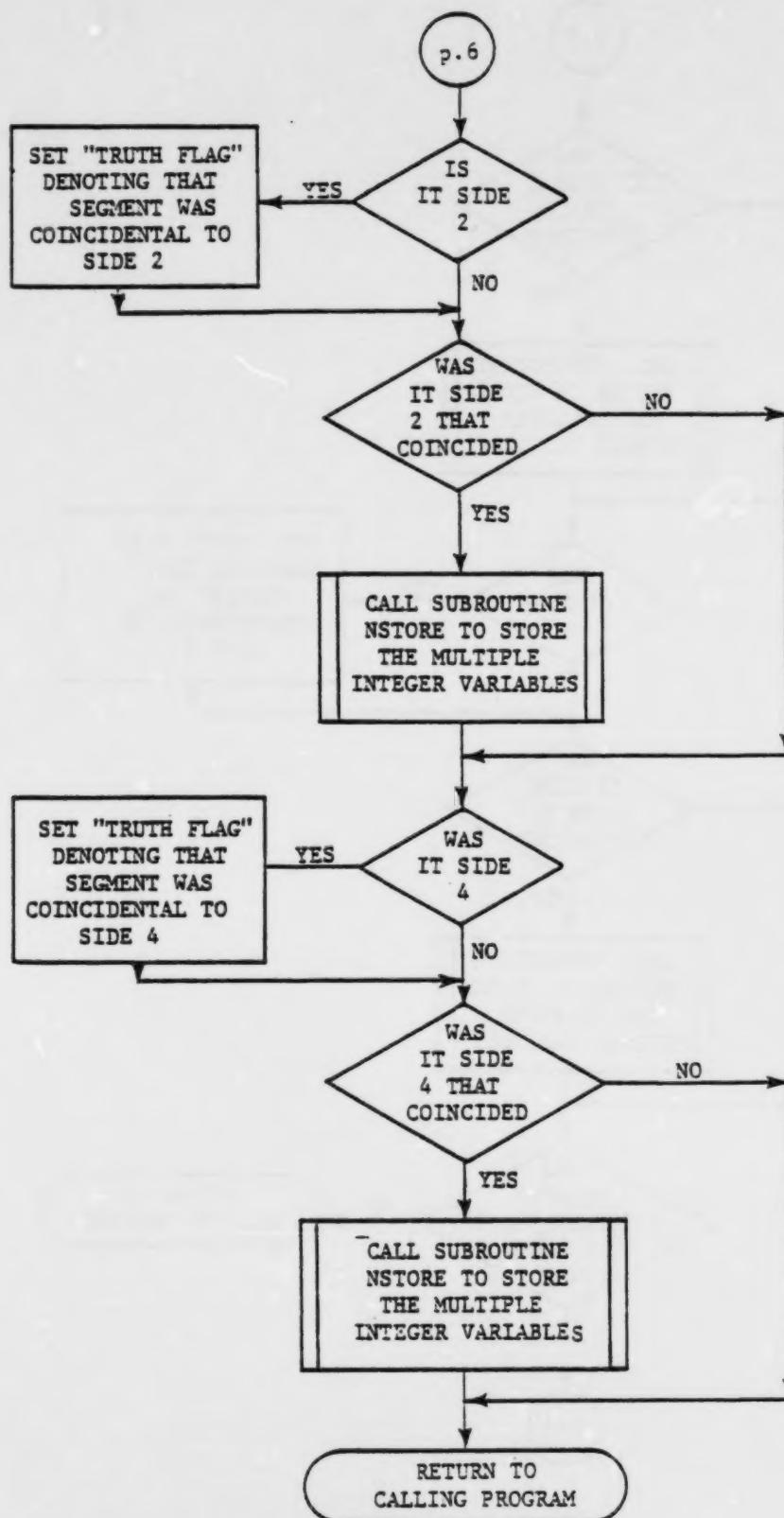


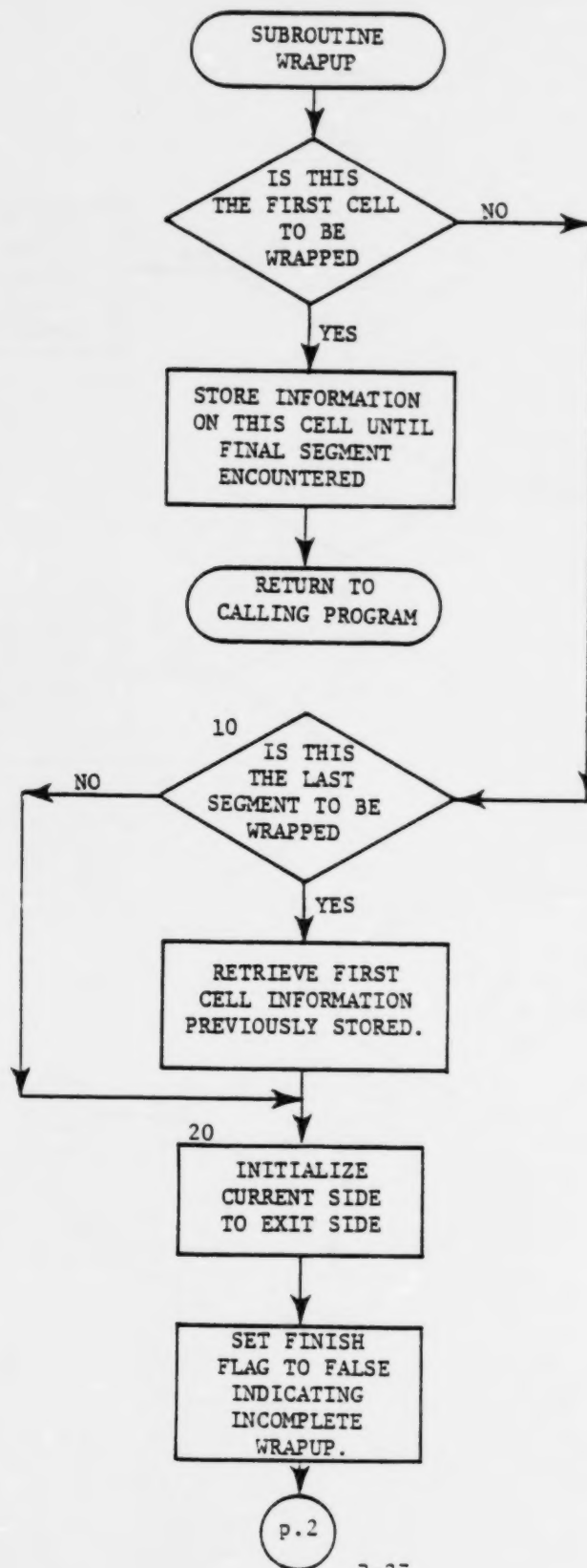


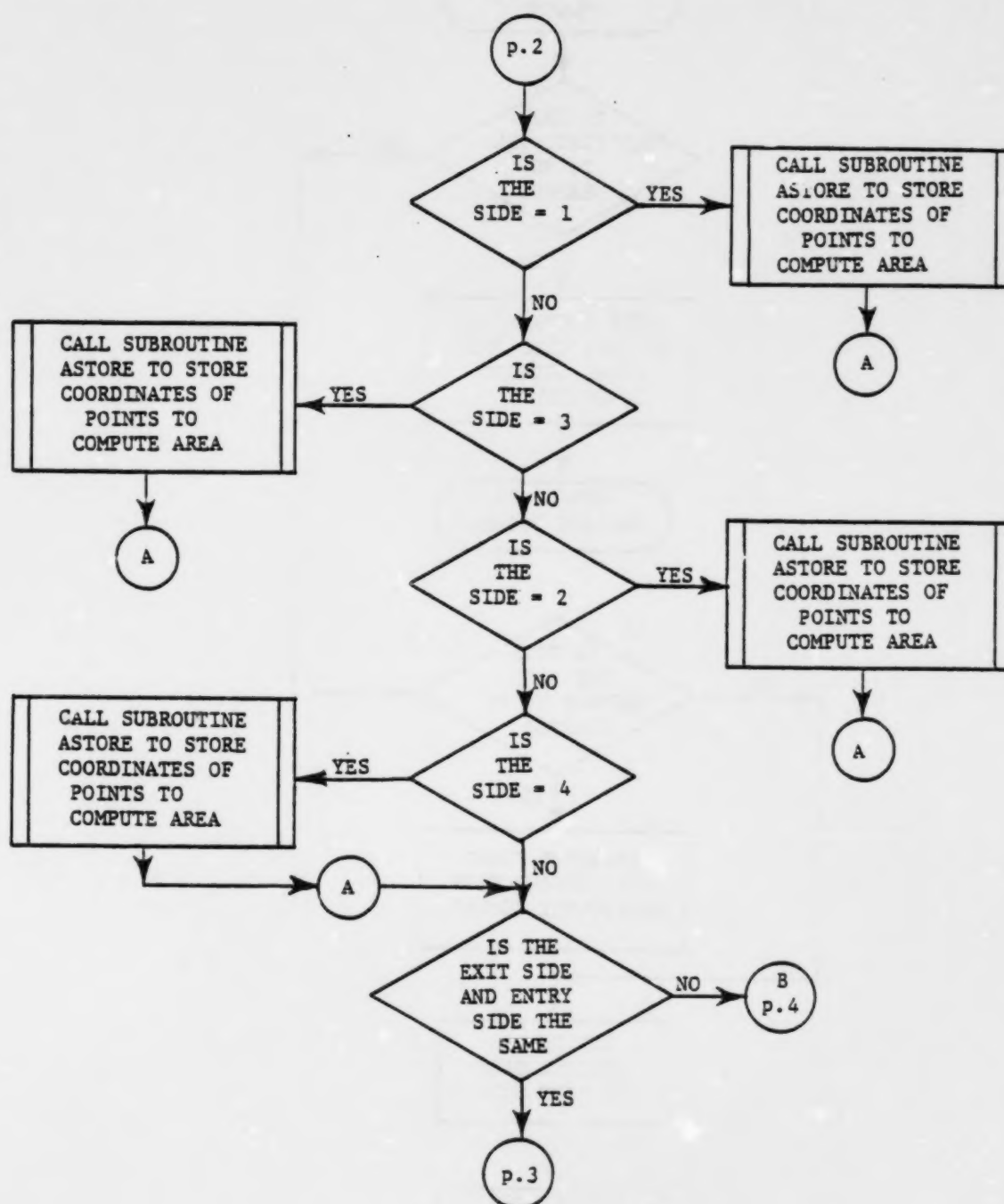


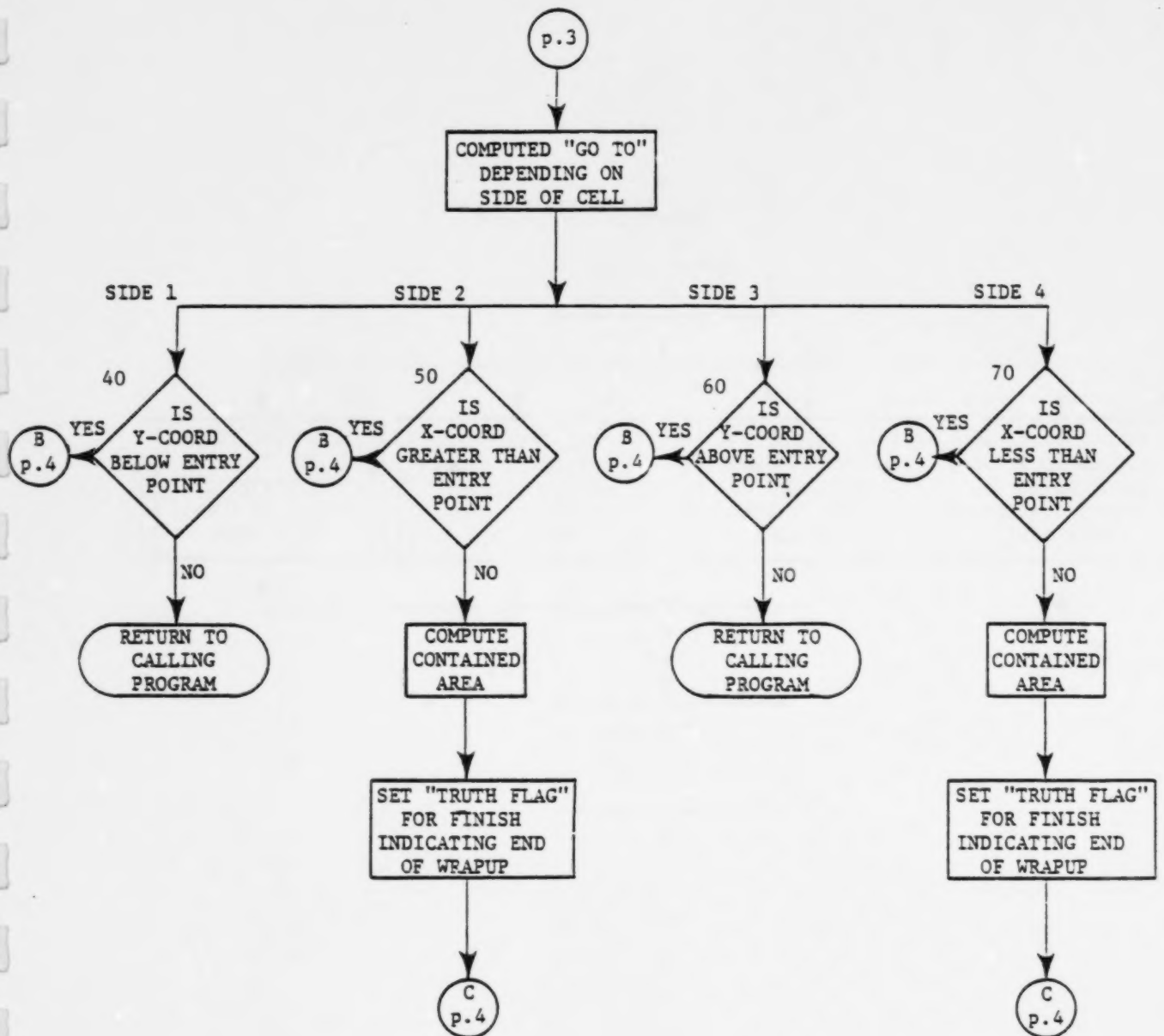


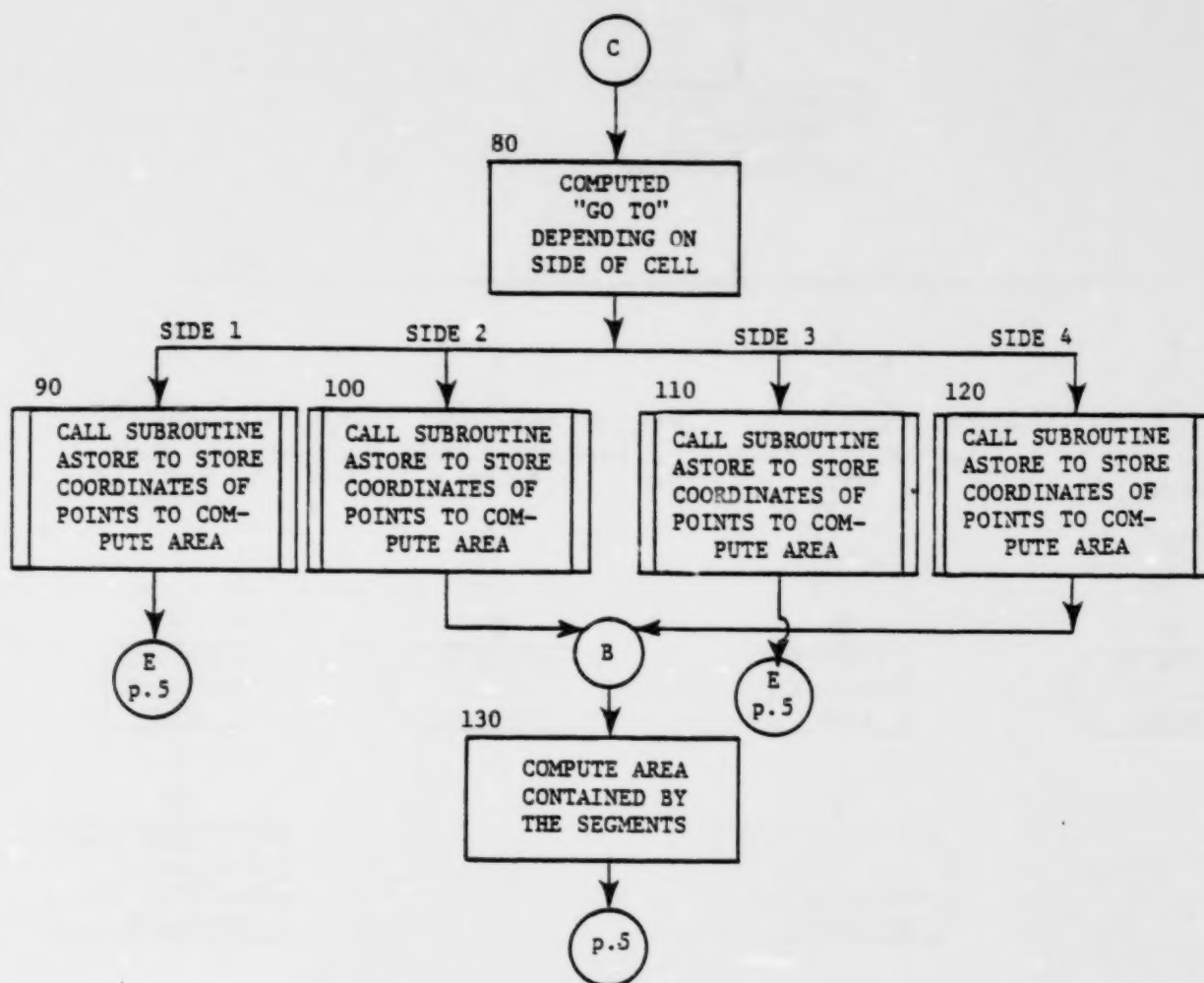


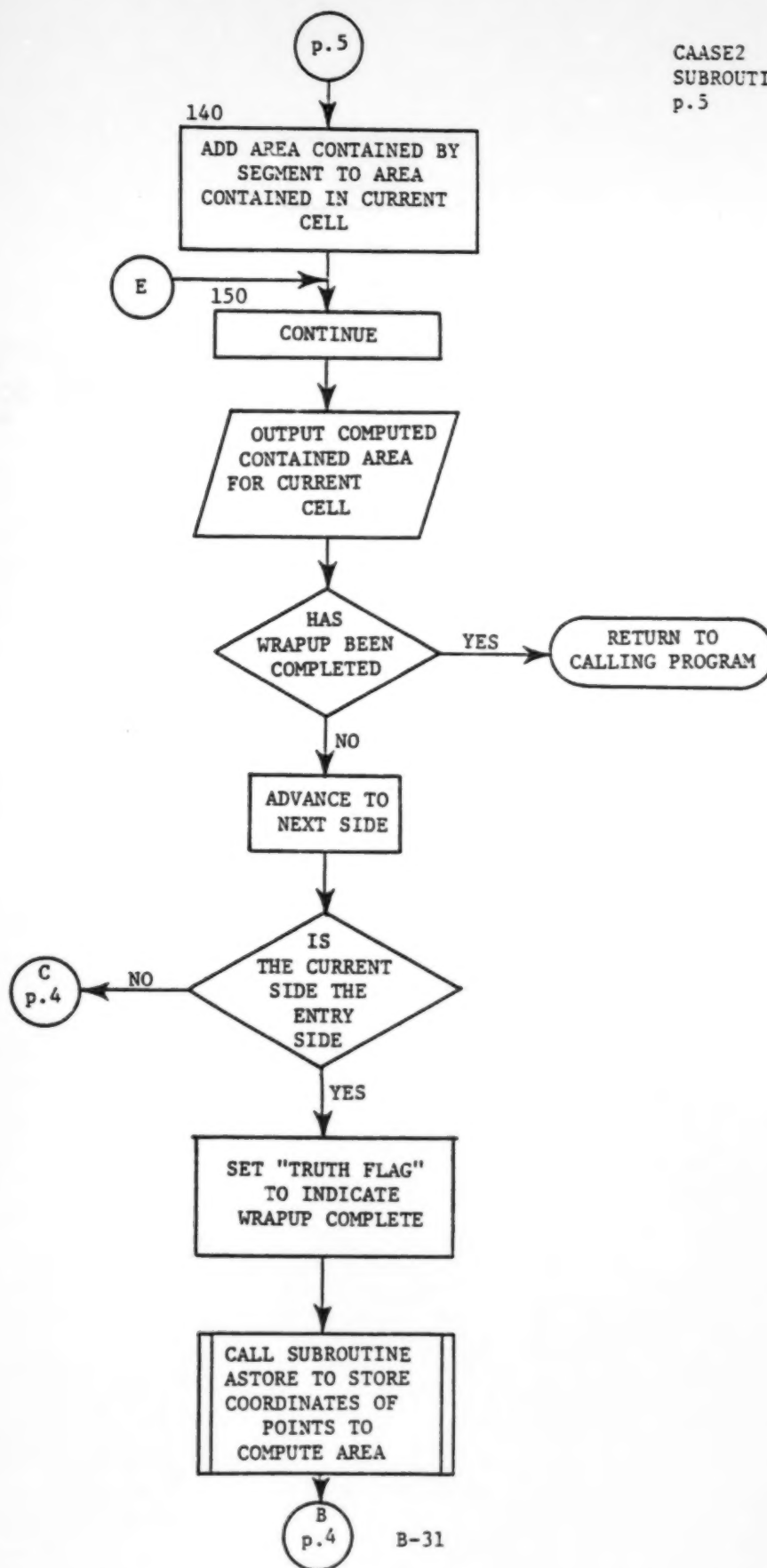


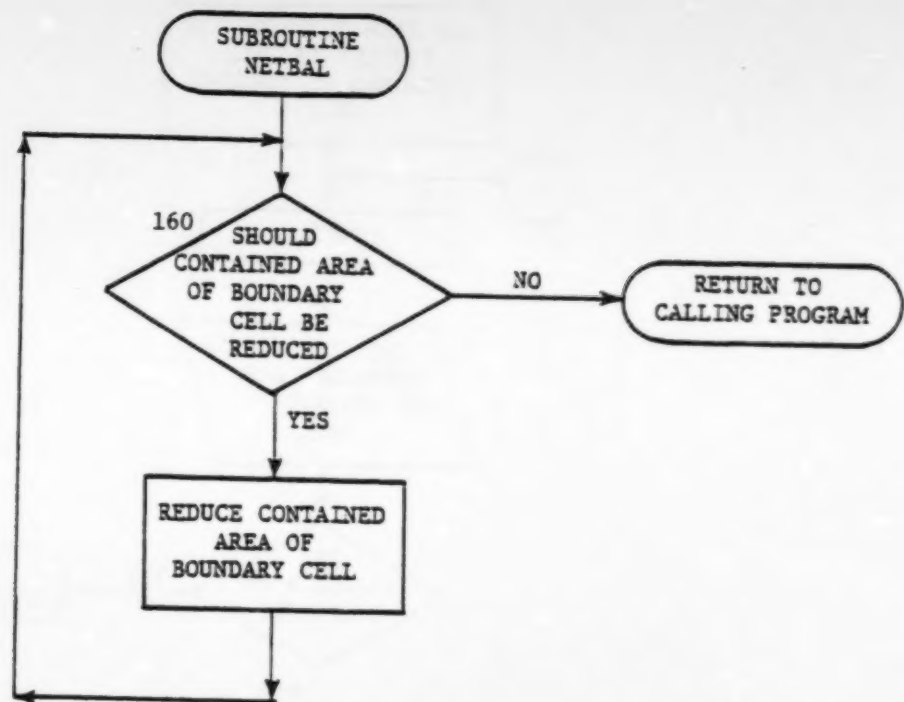


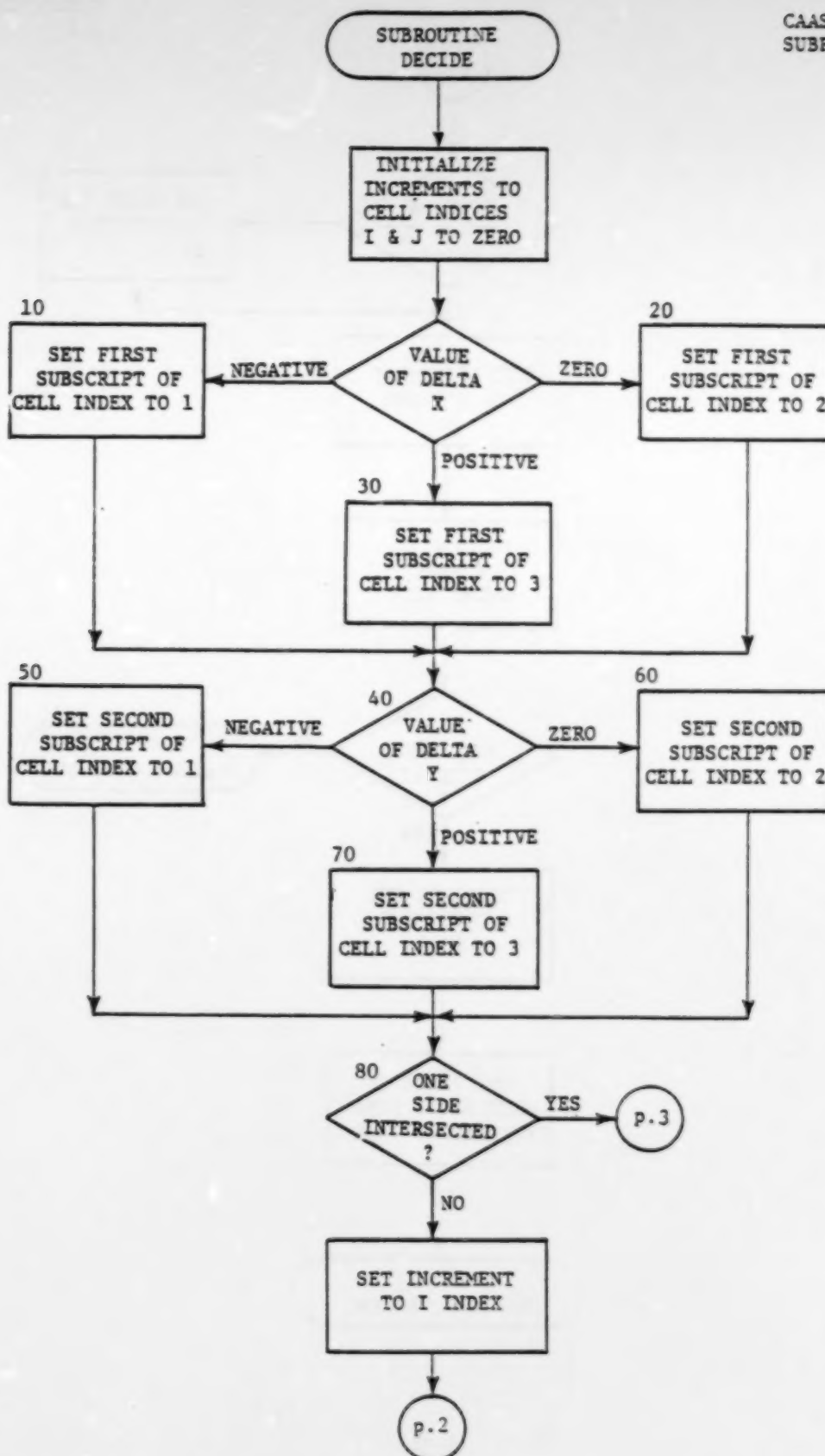


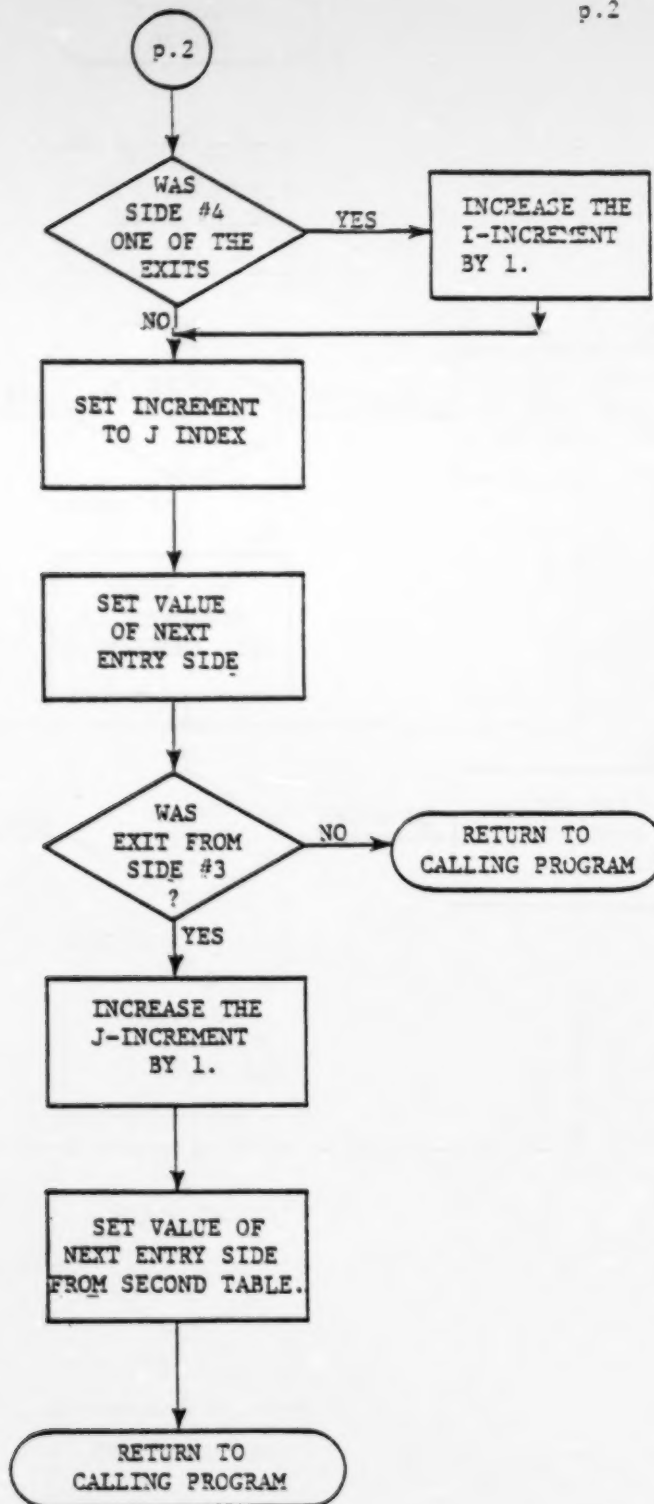


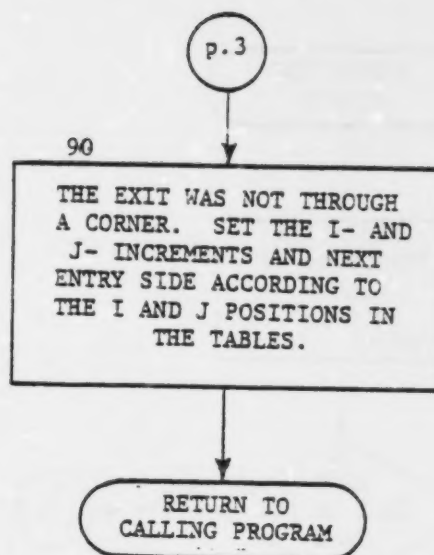


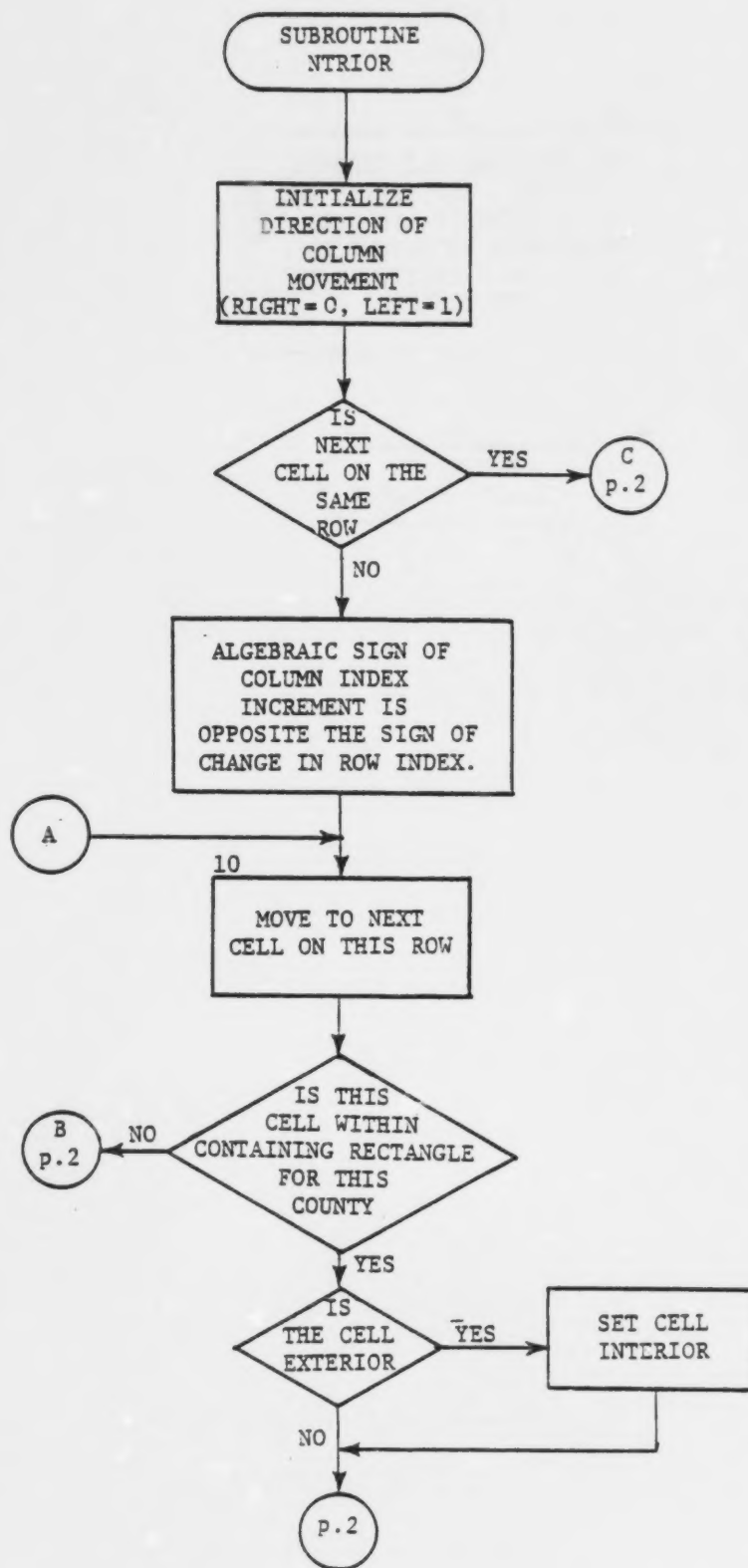


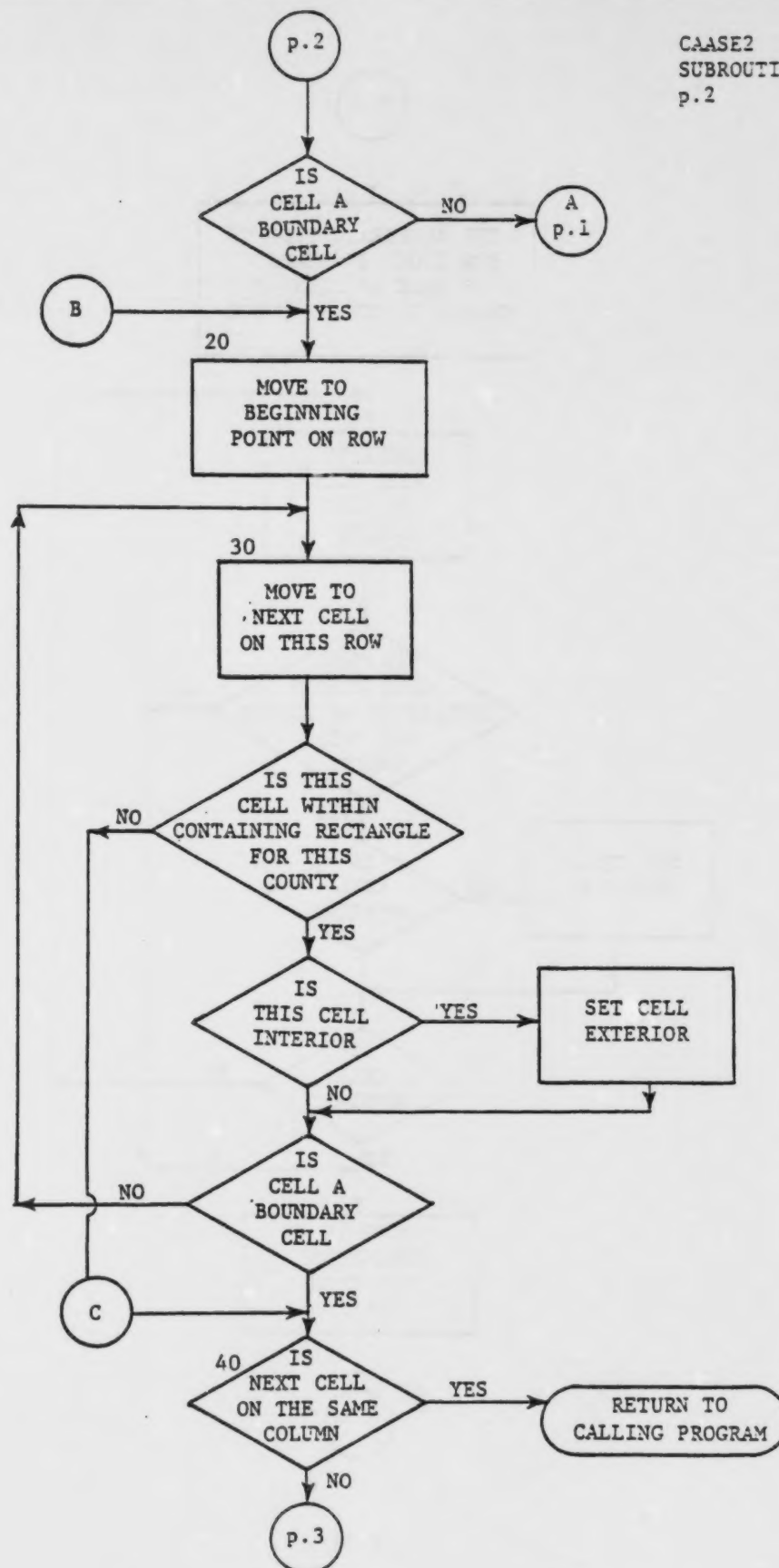


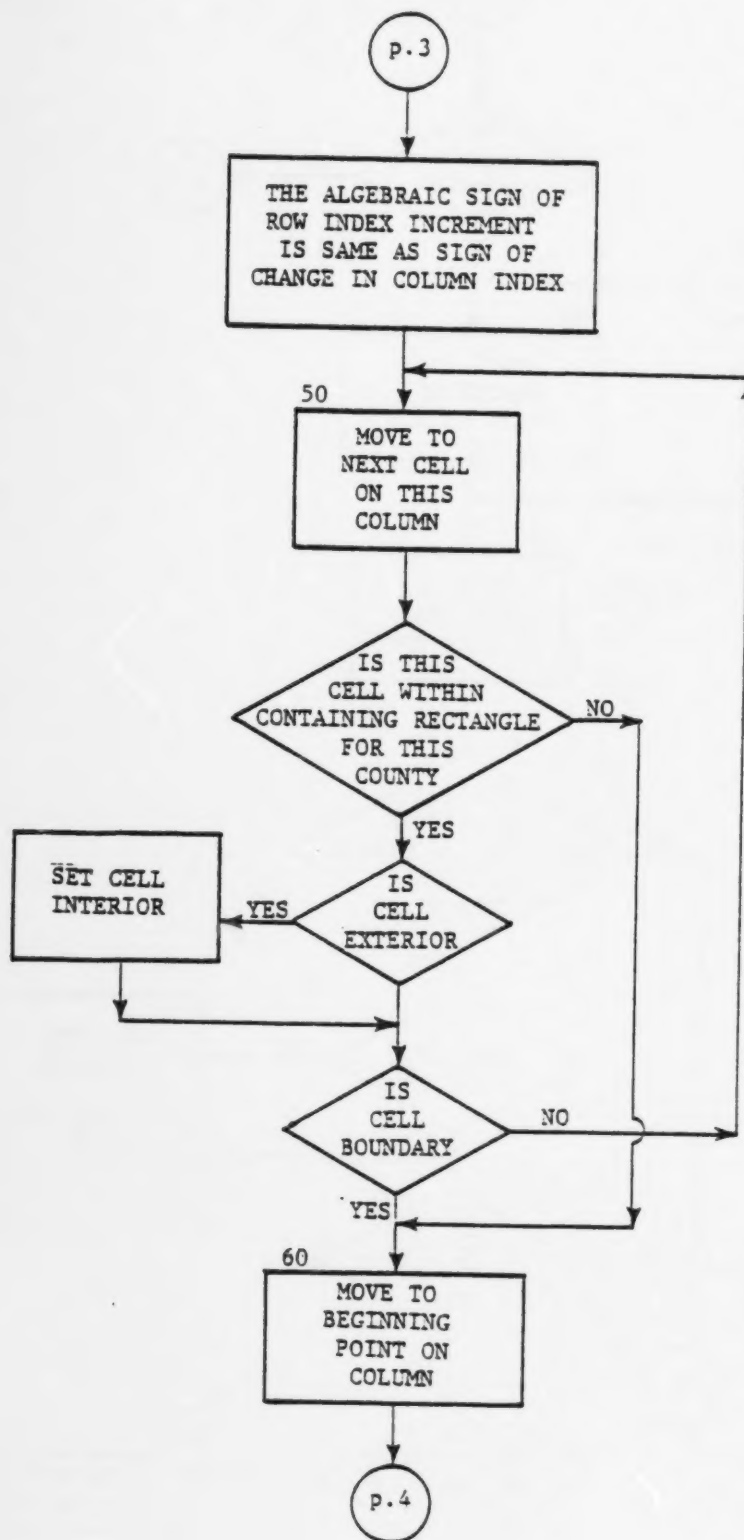


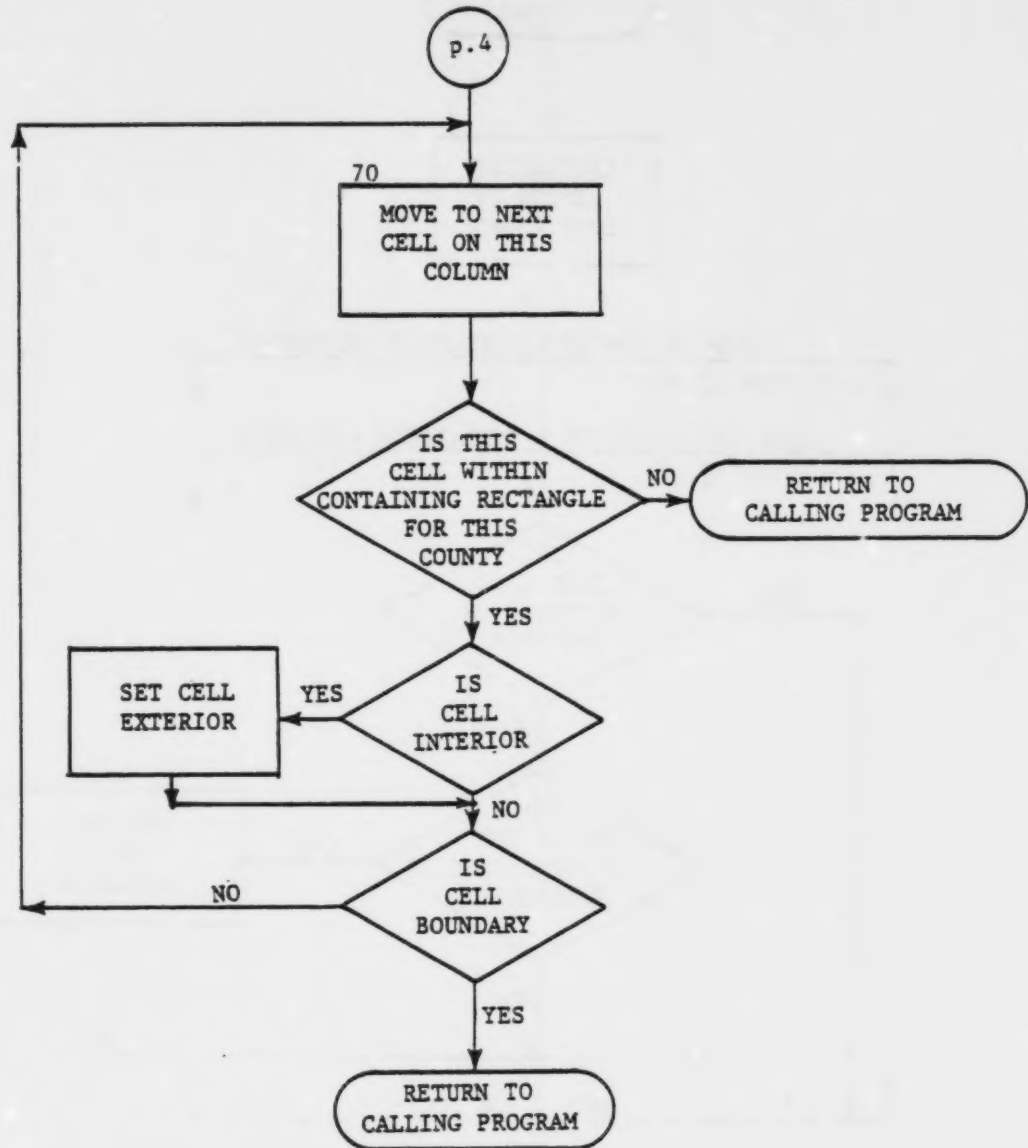


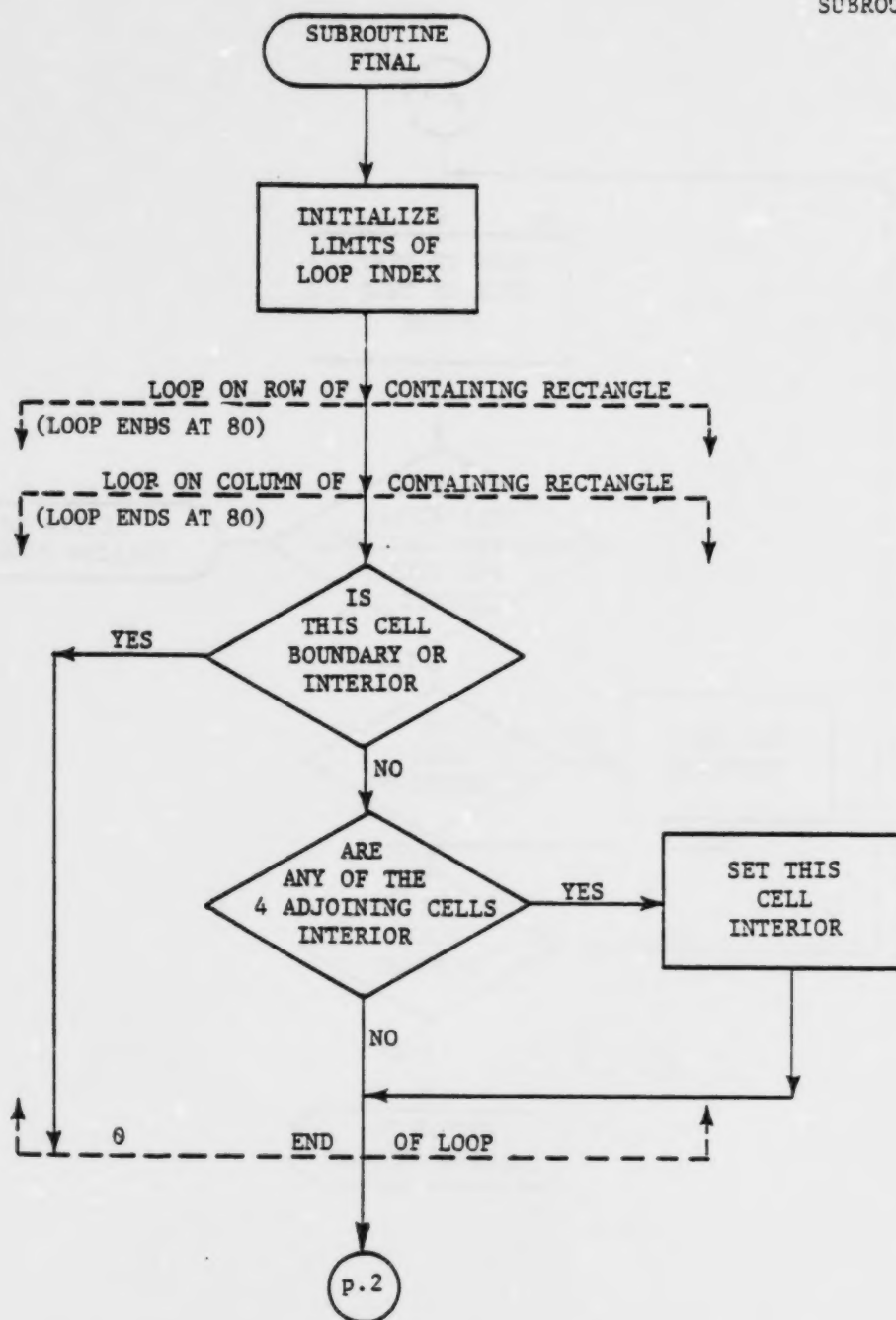


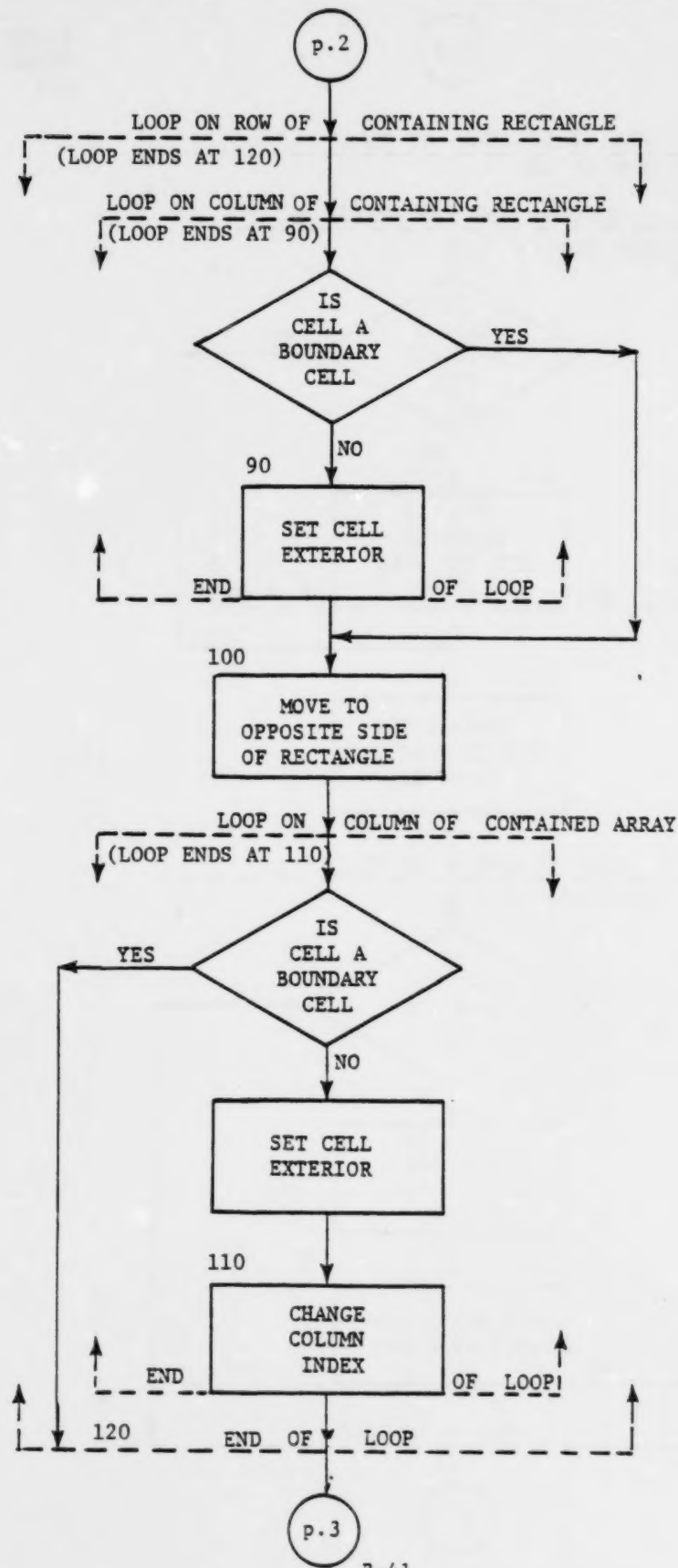


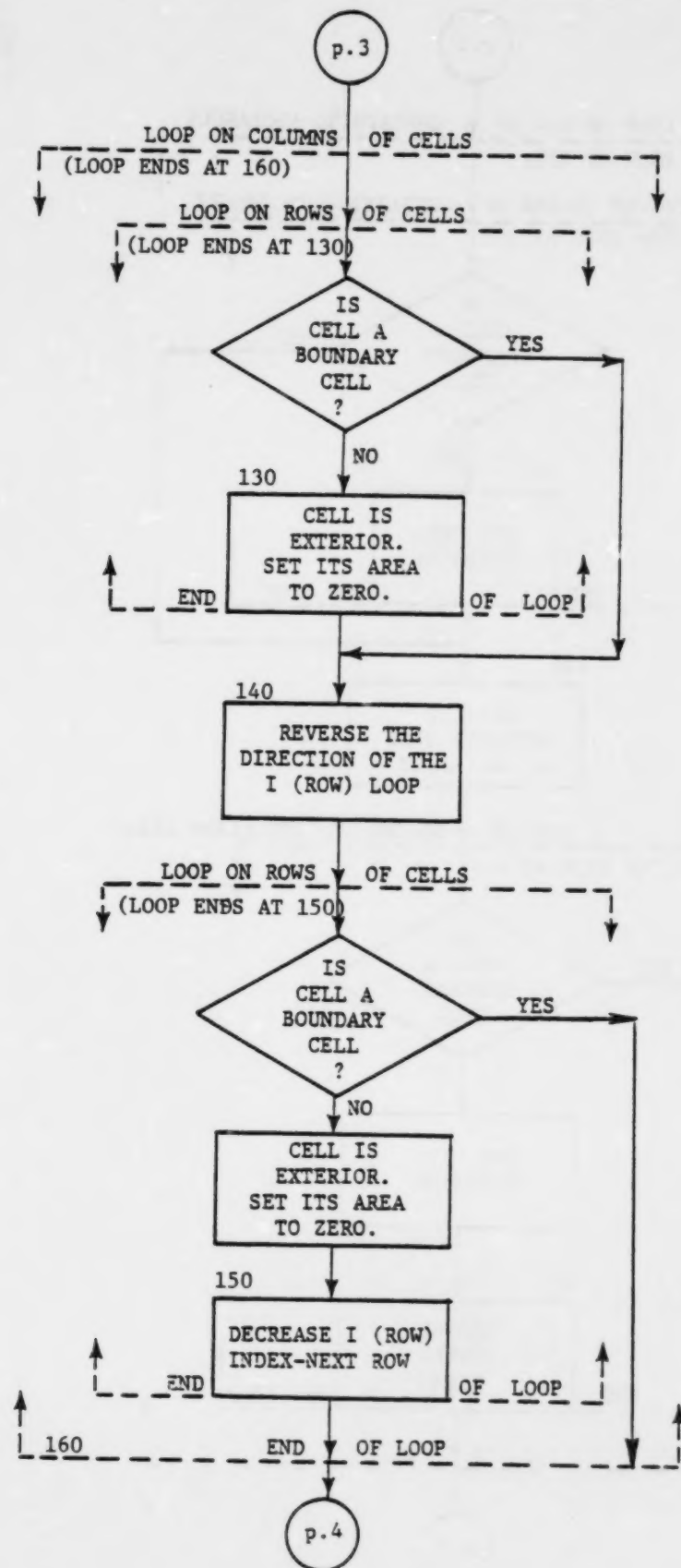


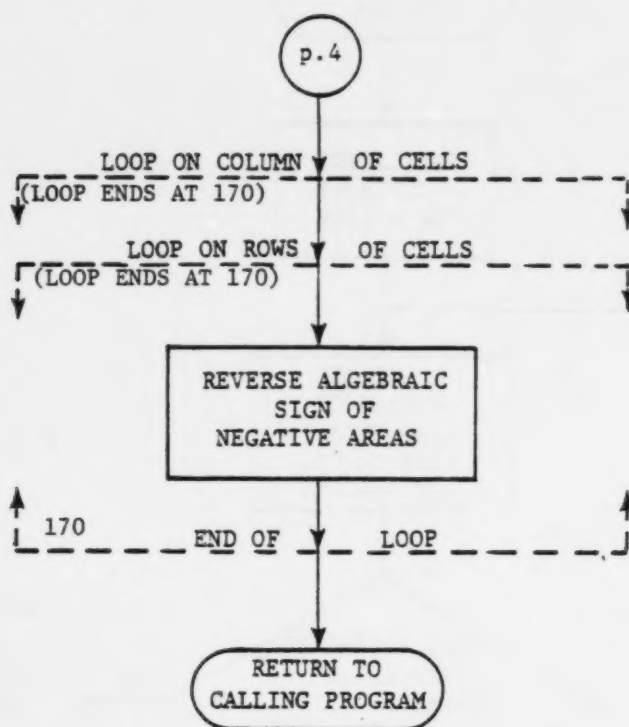


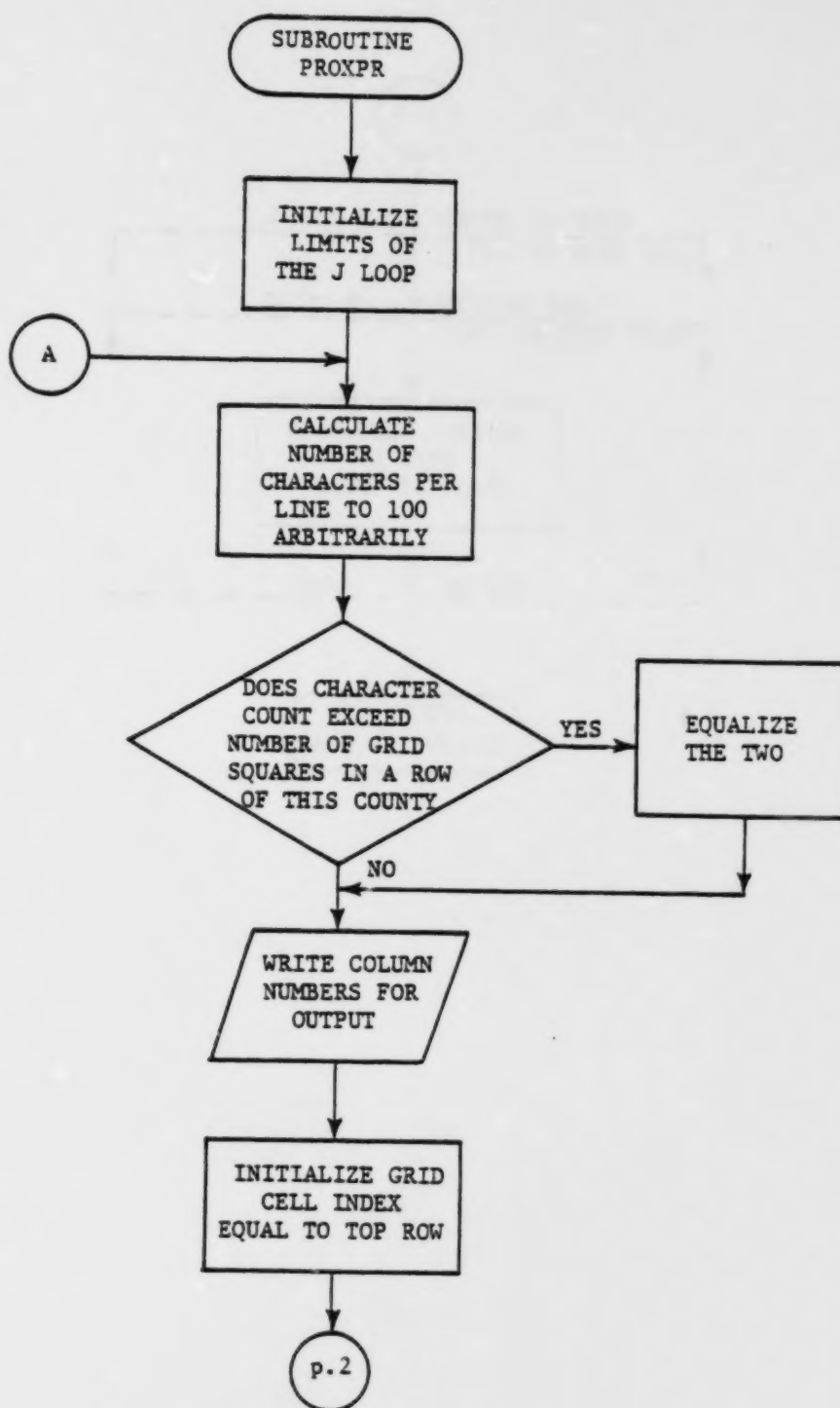


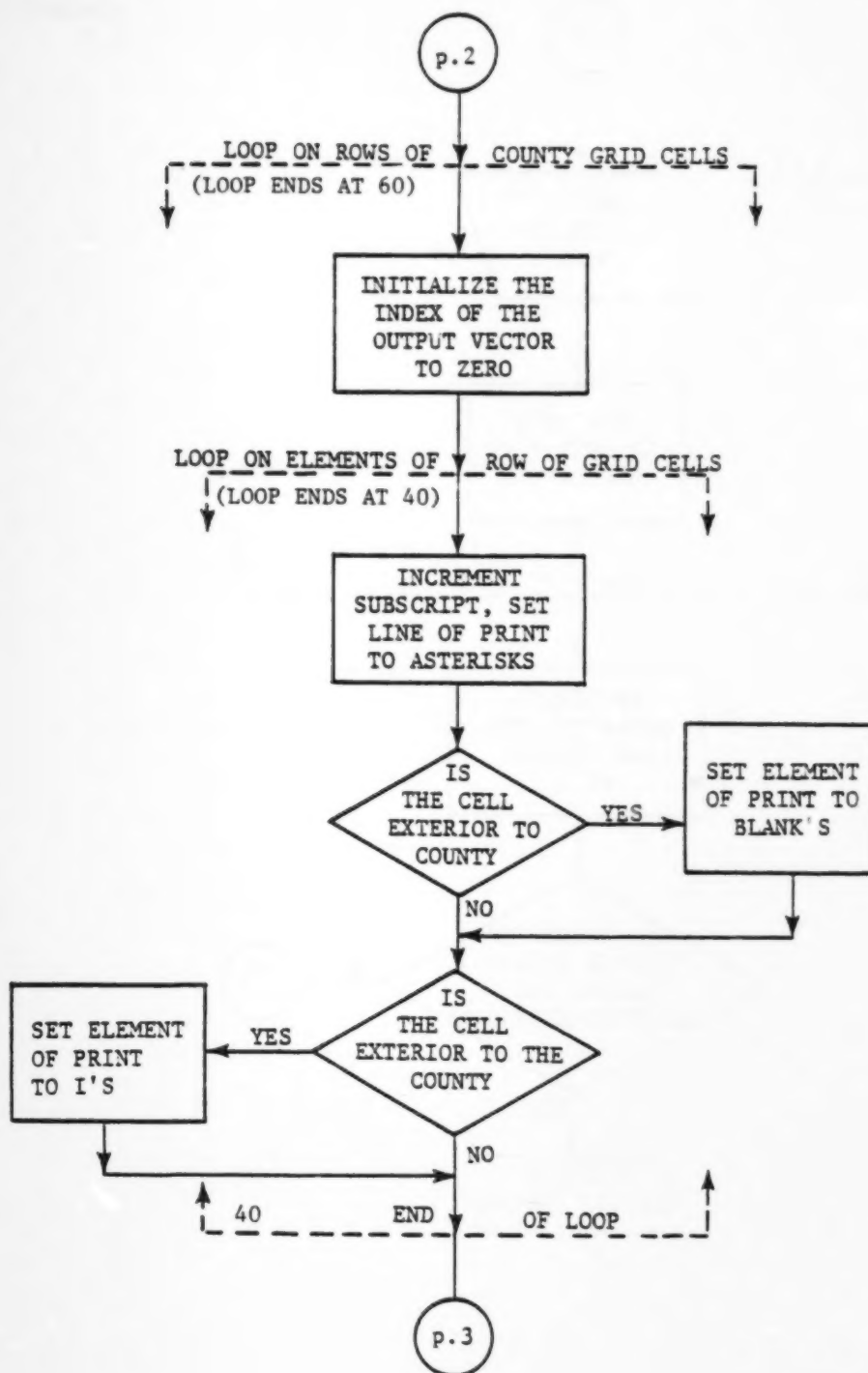


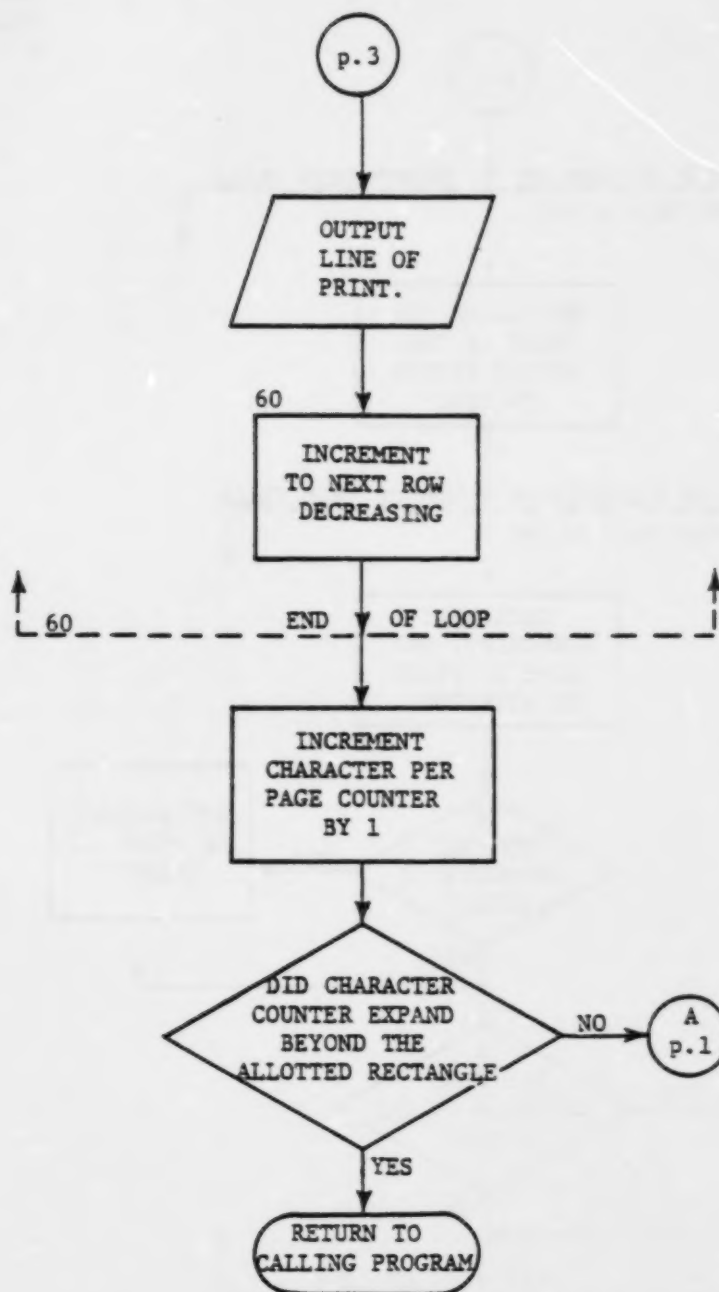


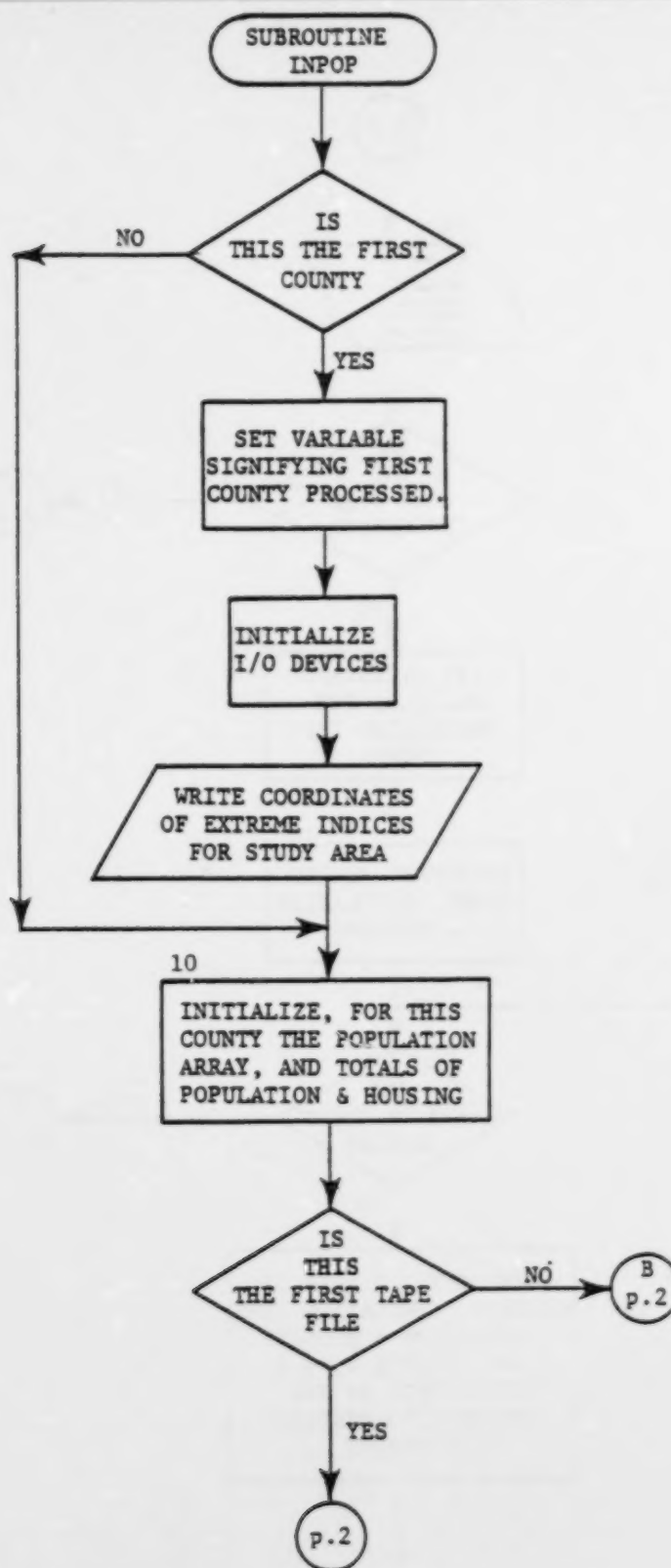


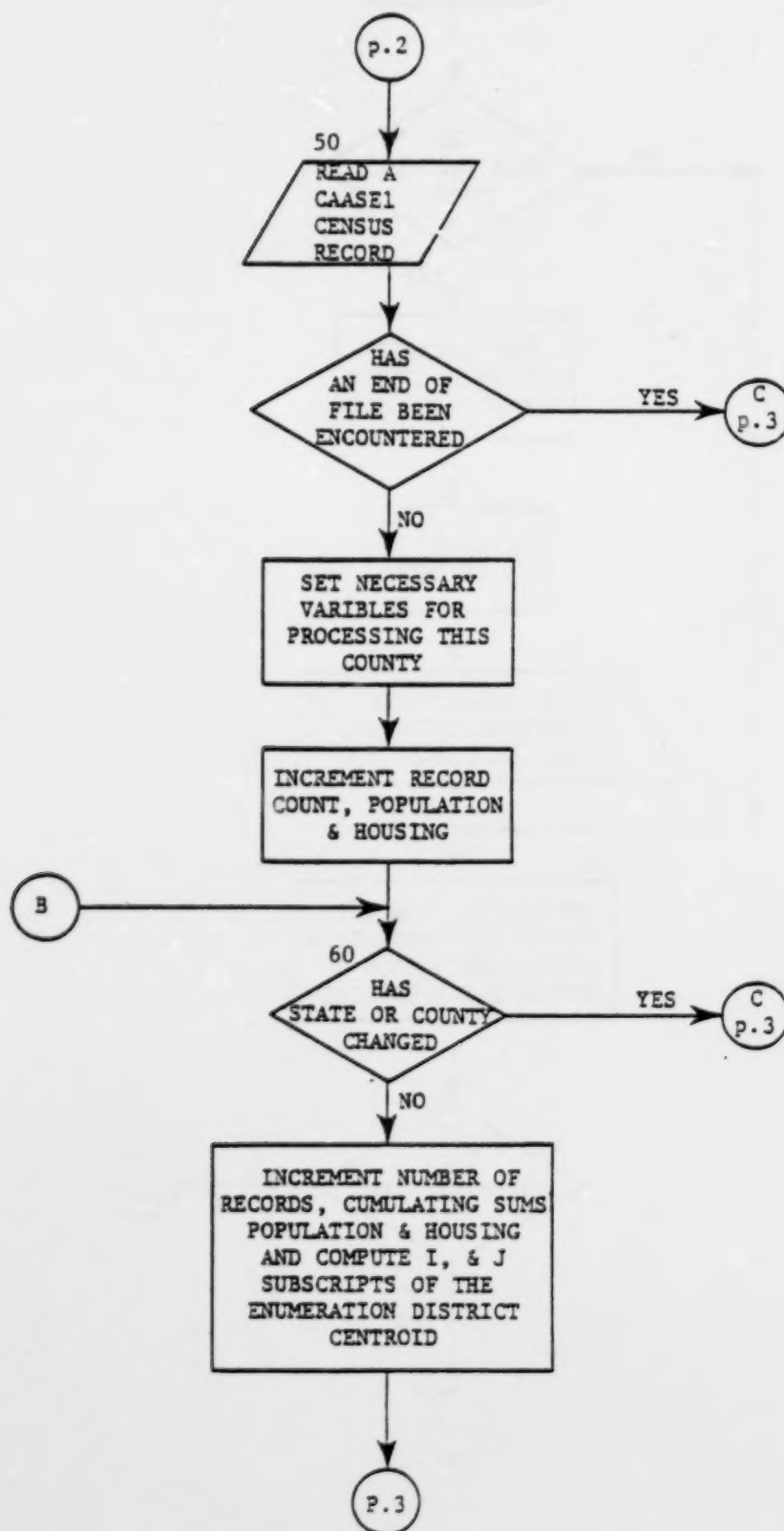


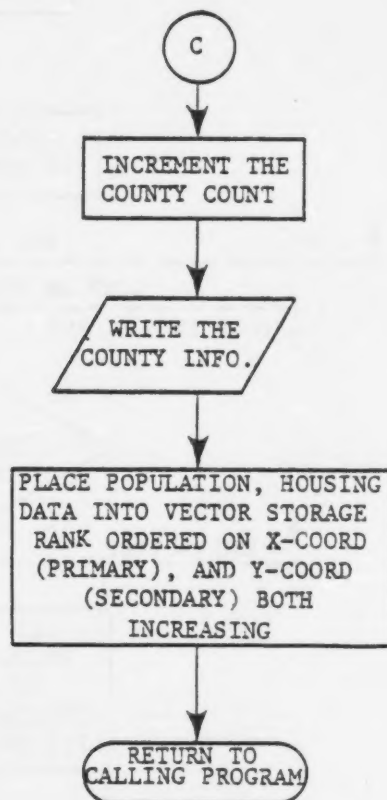
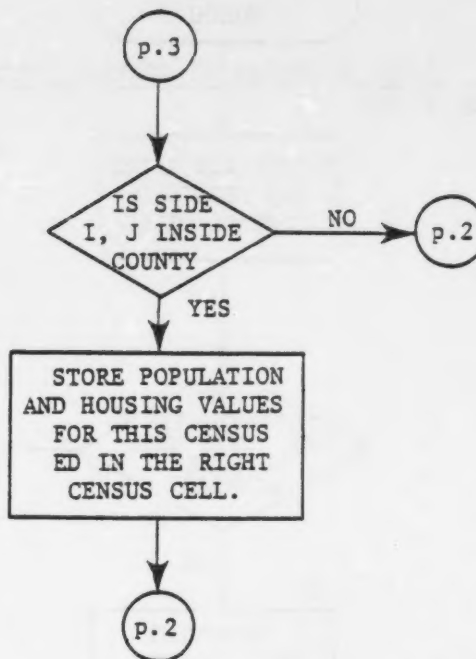






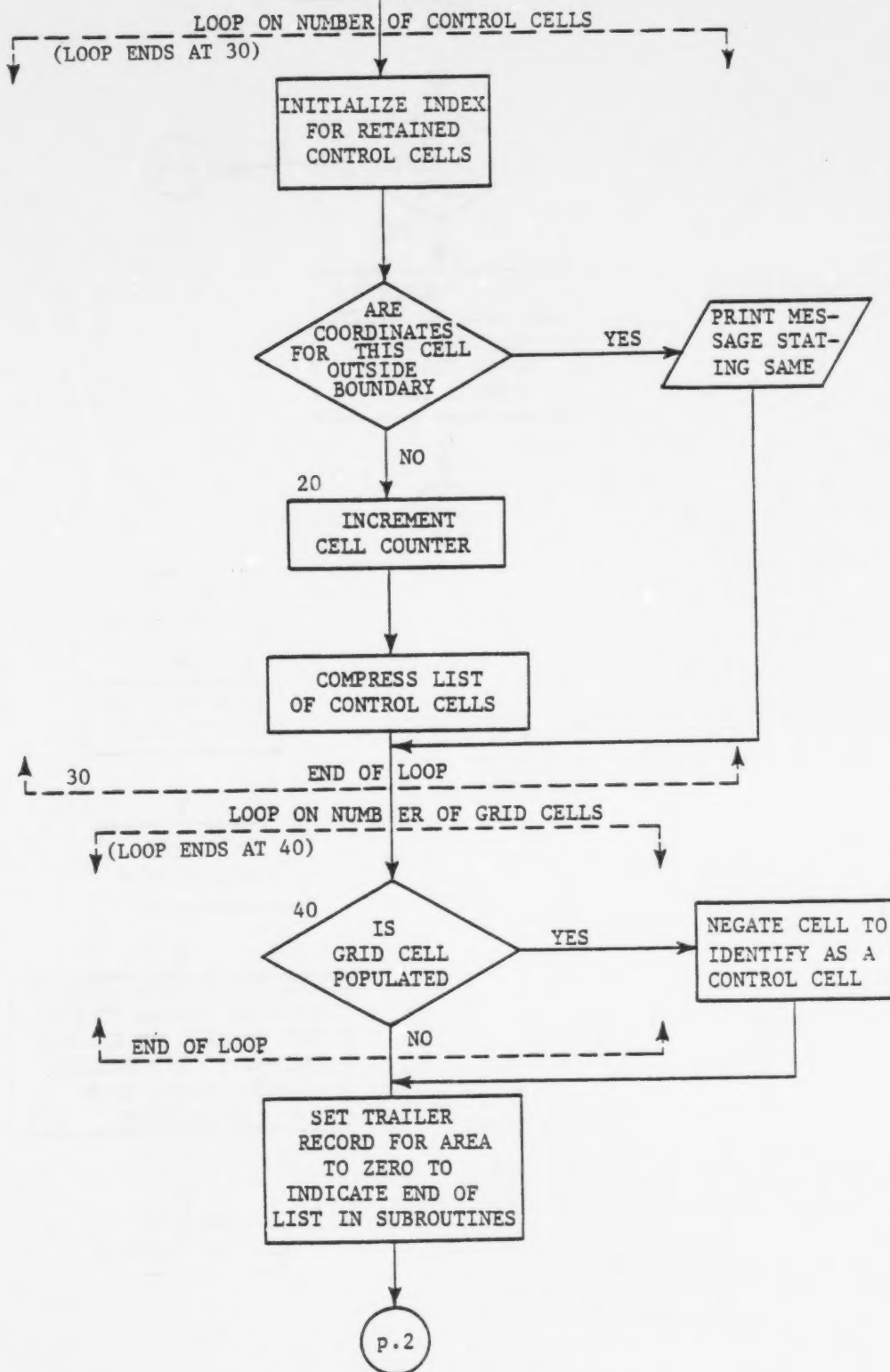


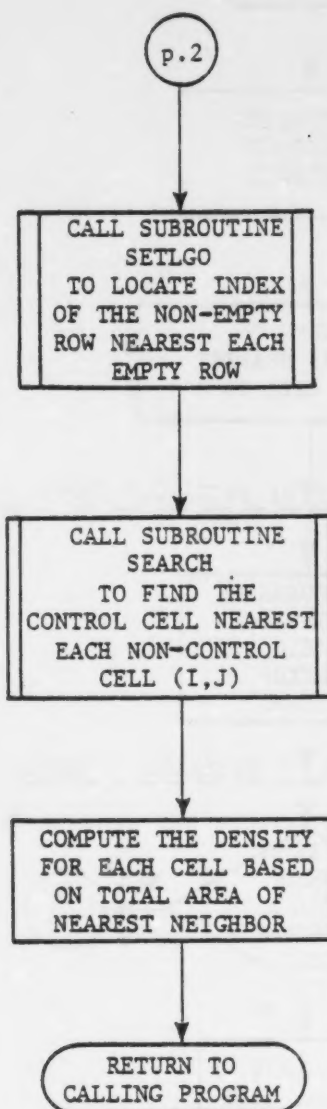


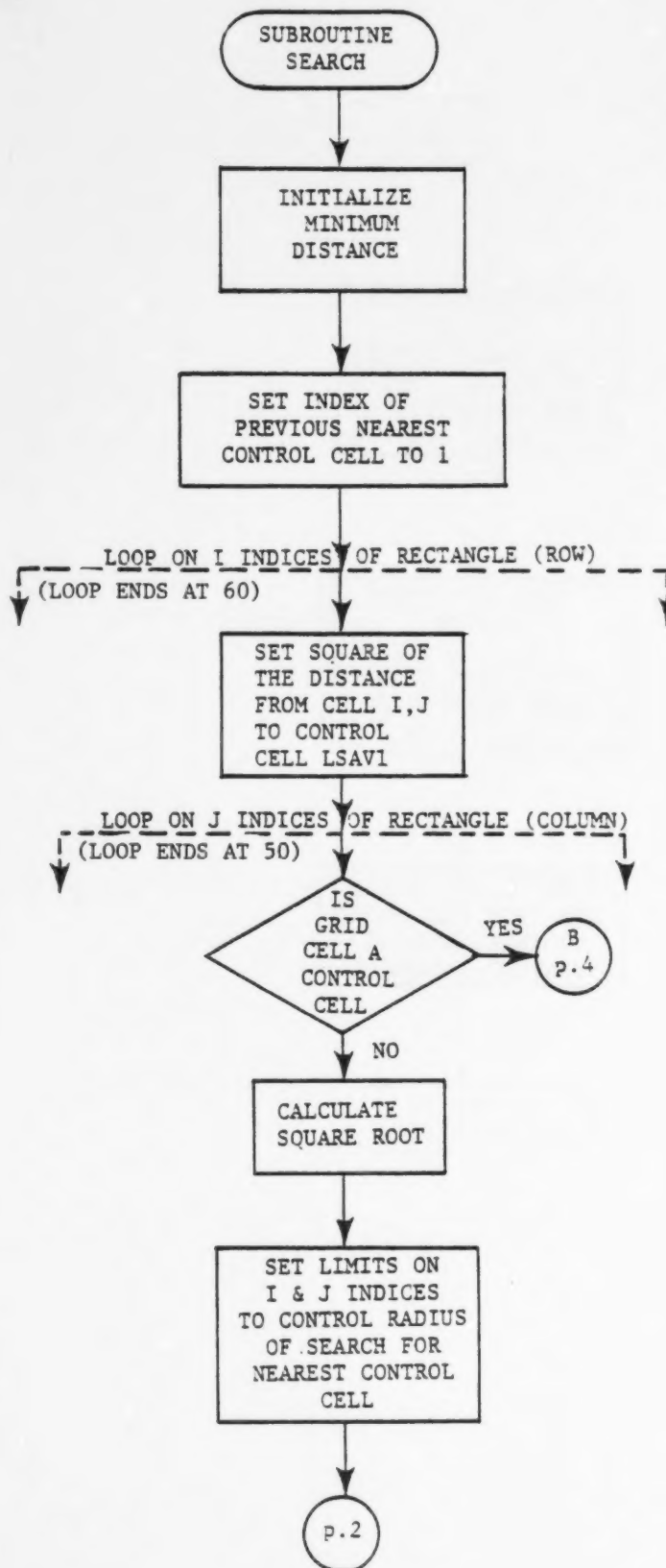


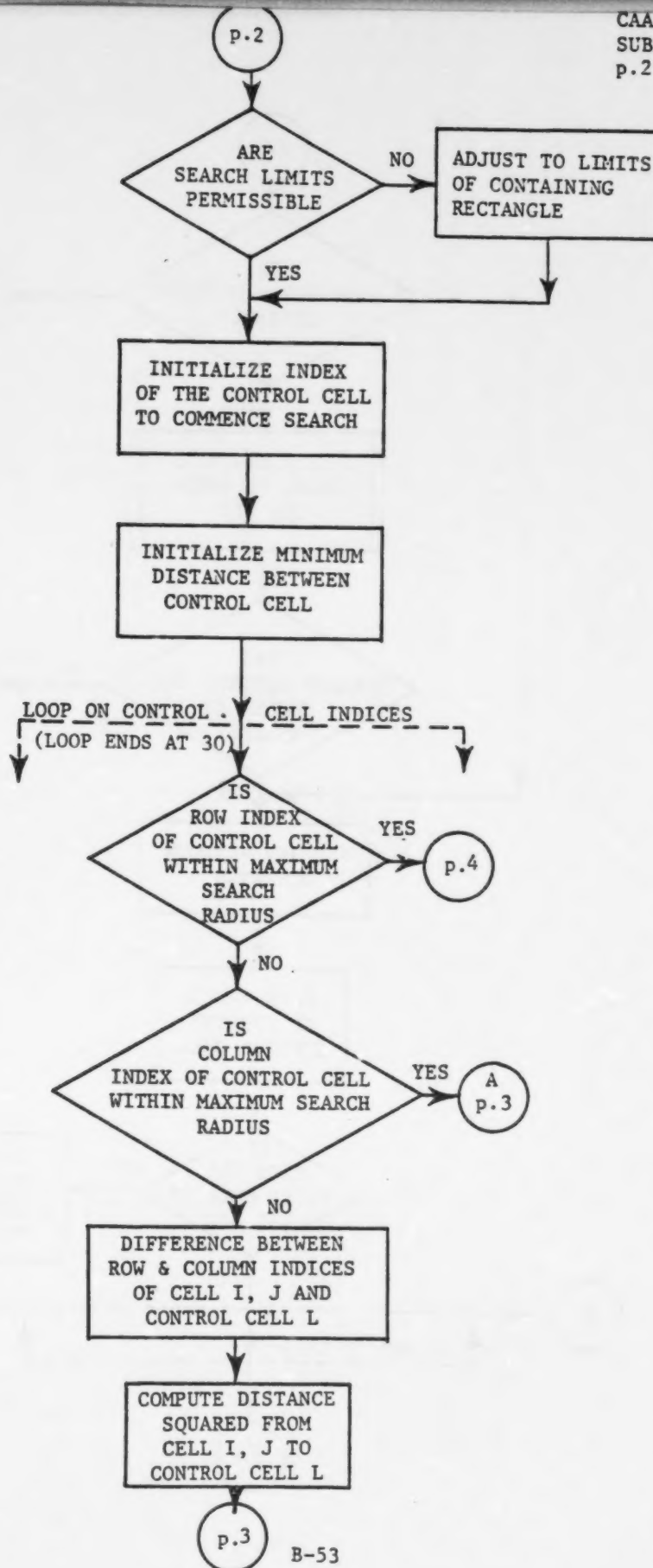
SUBROUTINE
PROXML

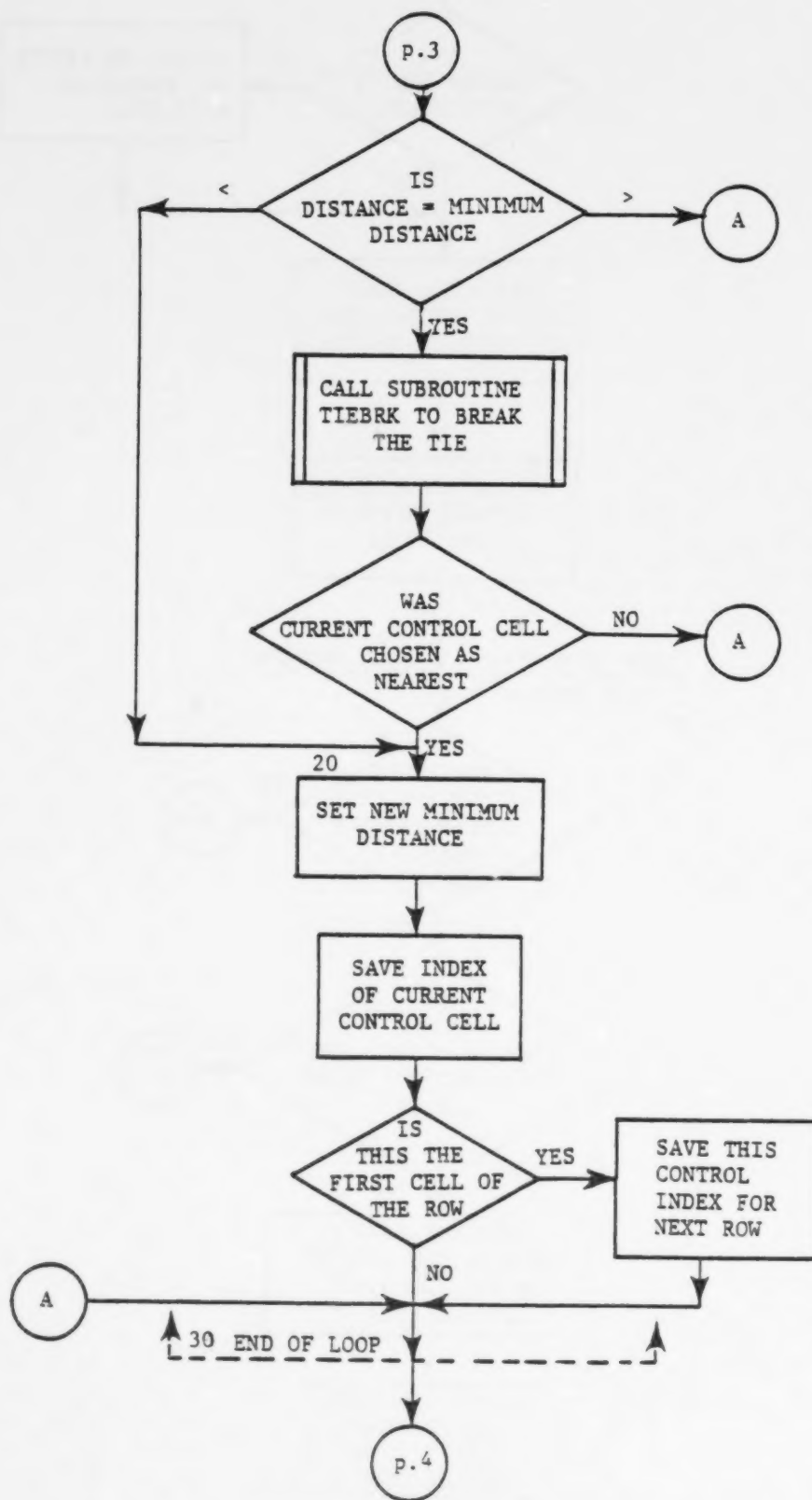
CAASE2
SUBROUTINE PROXML

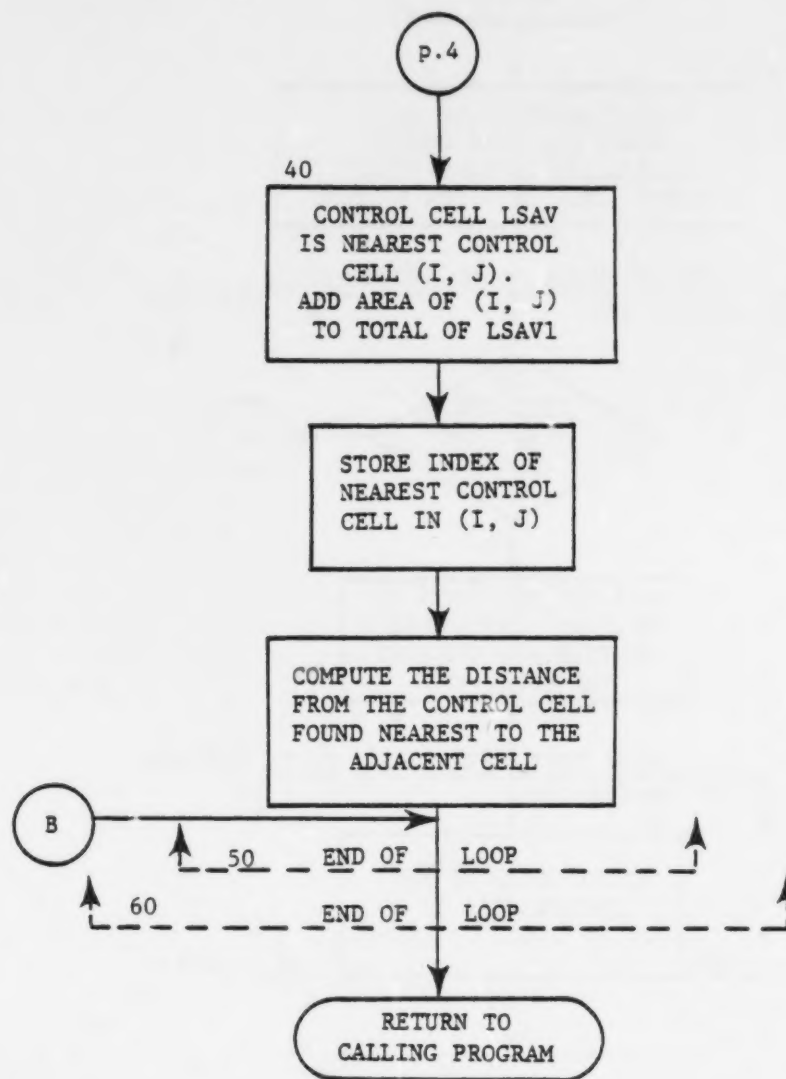


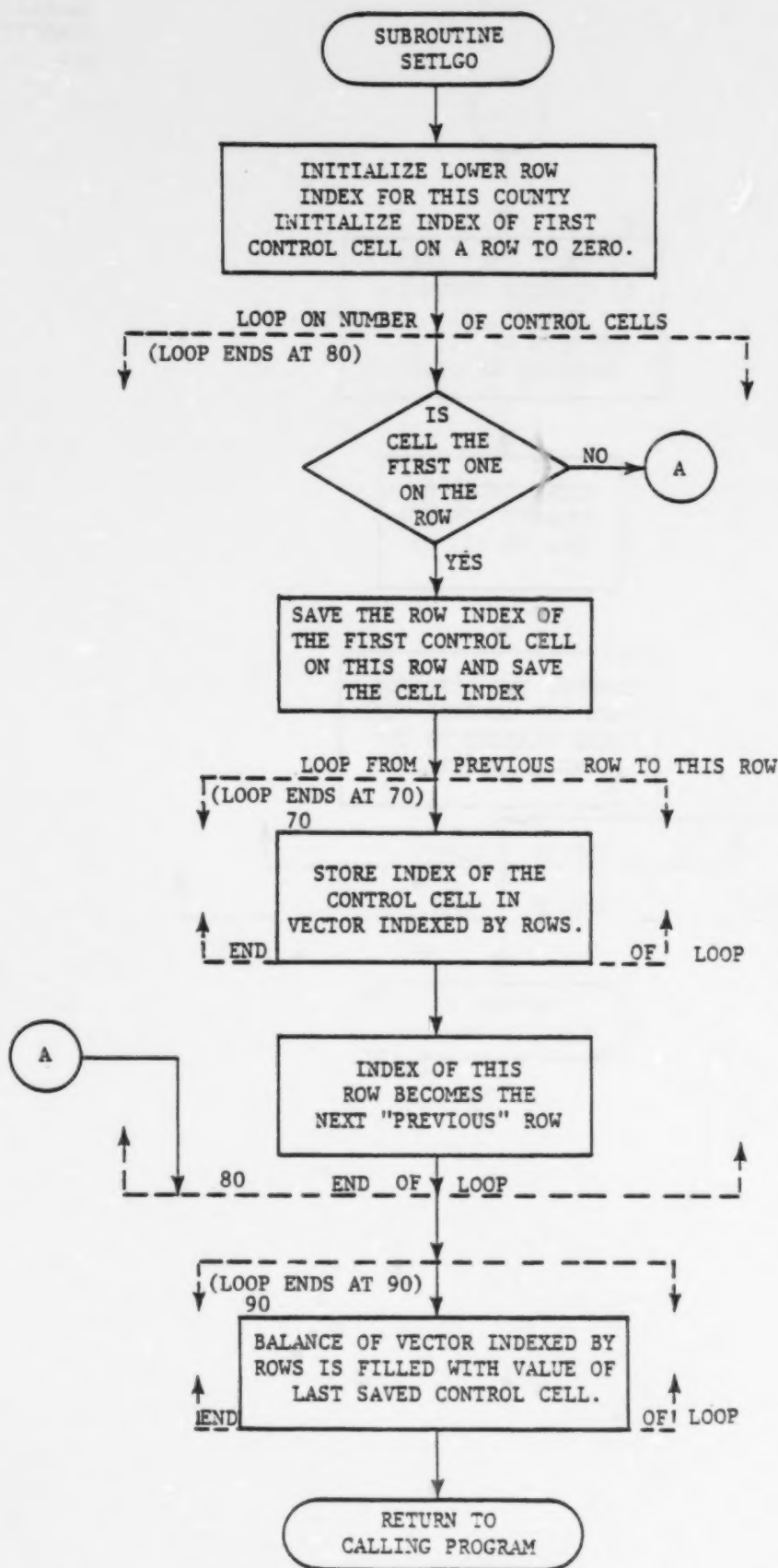


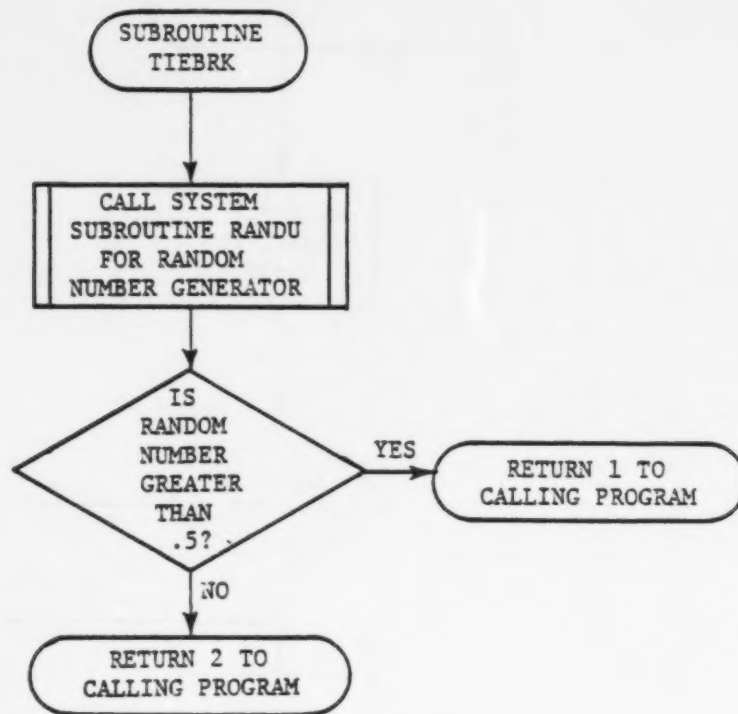


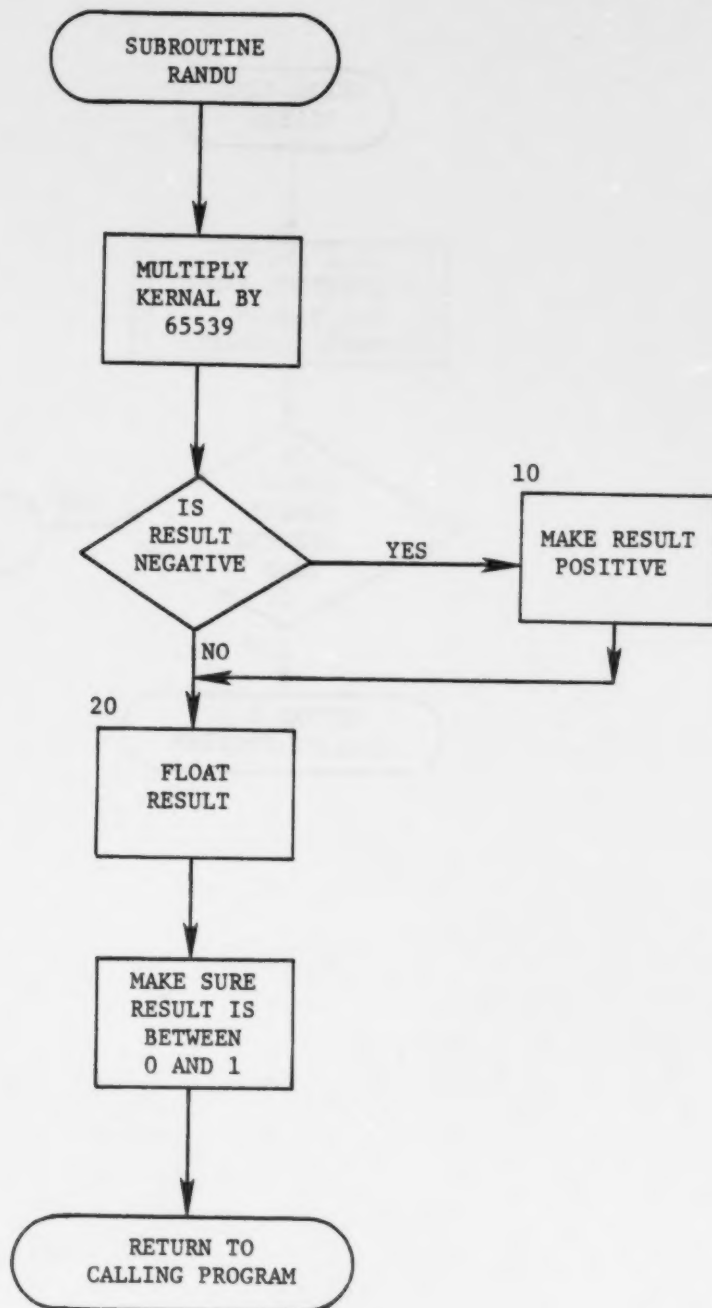


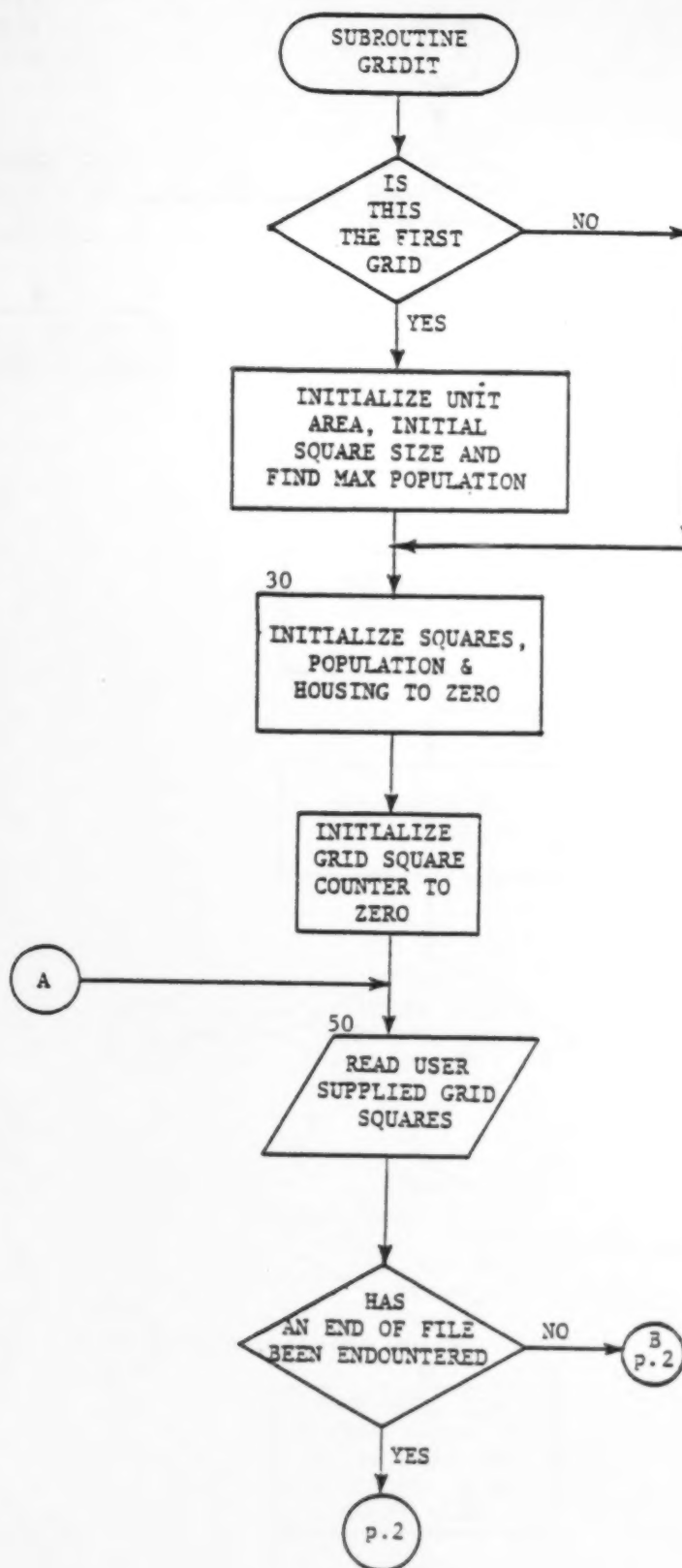


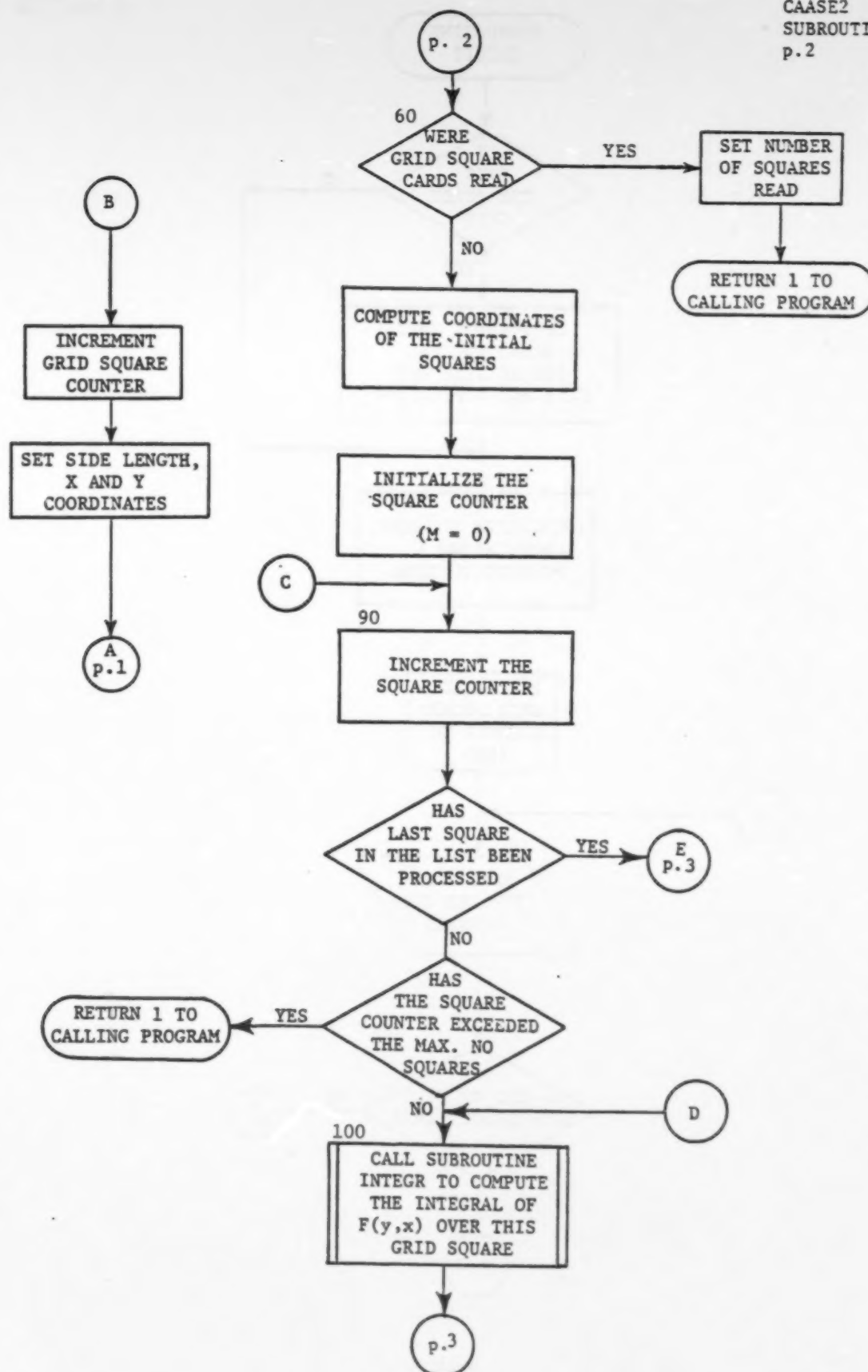


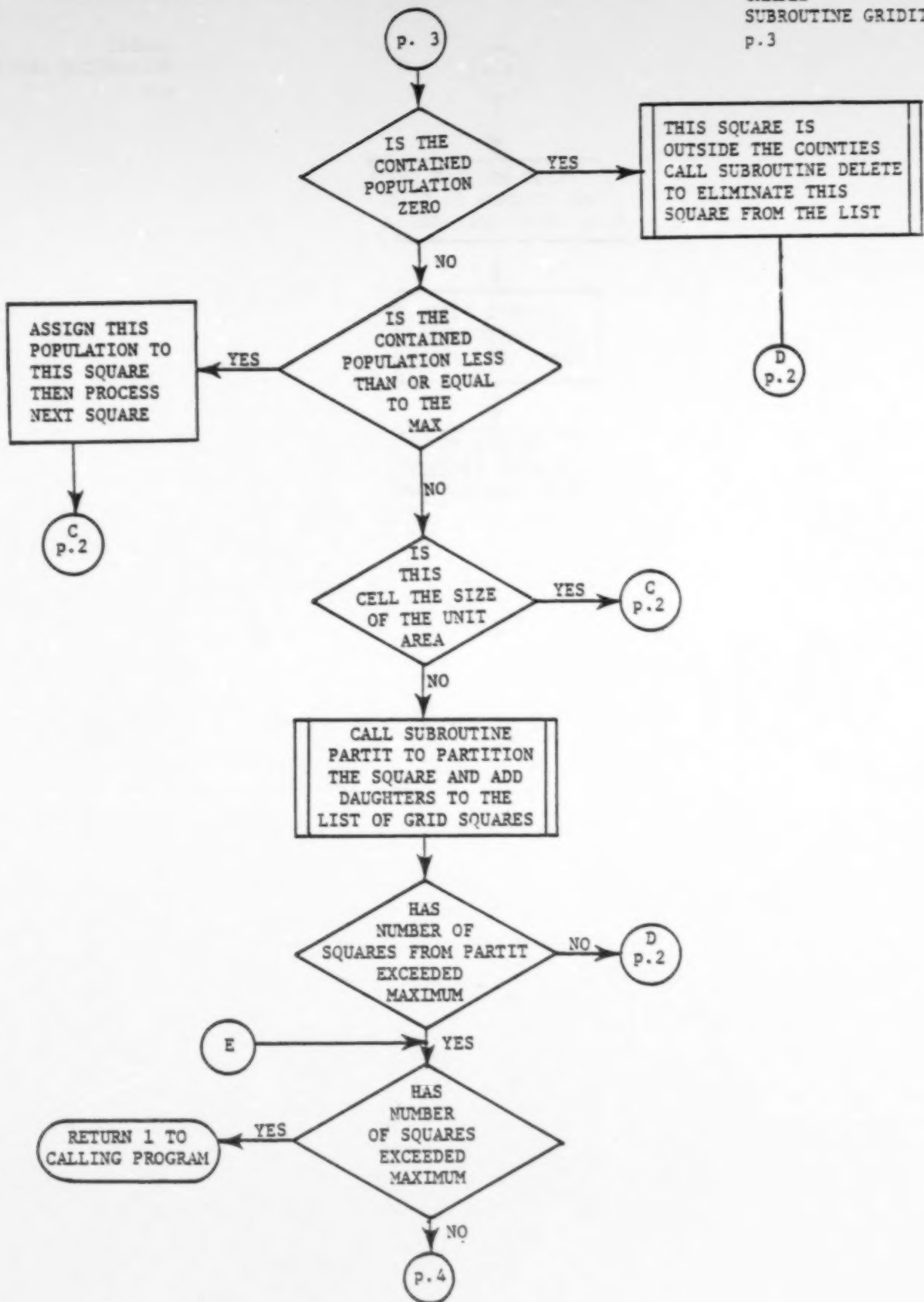


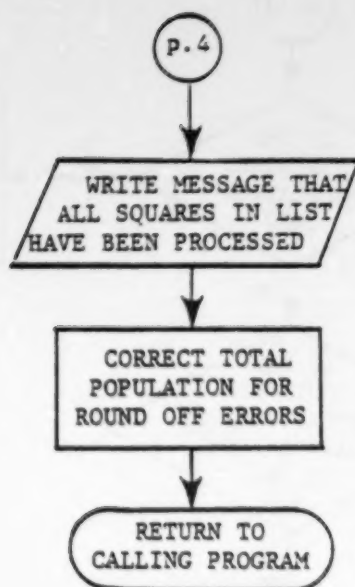


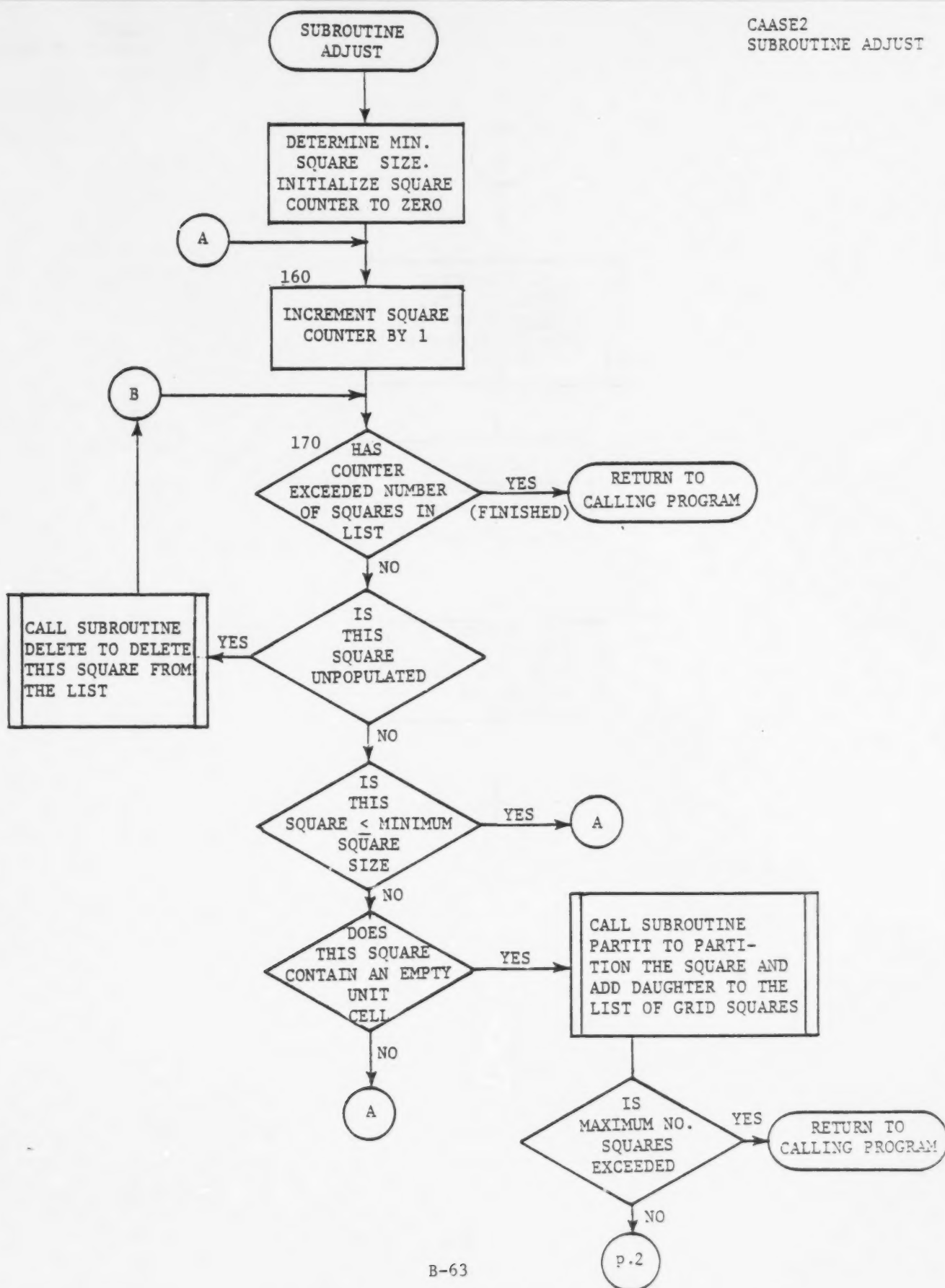


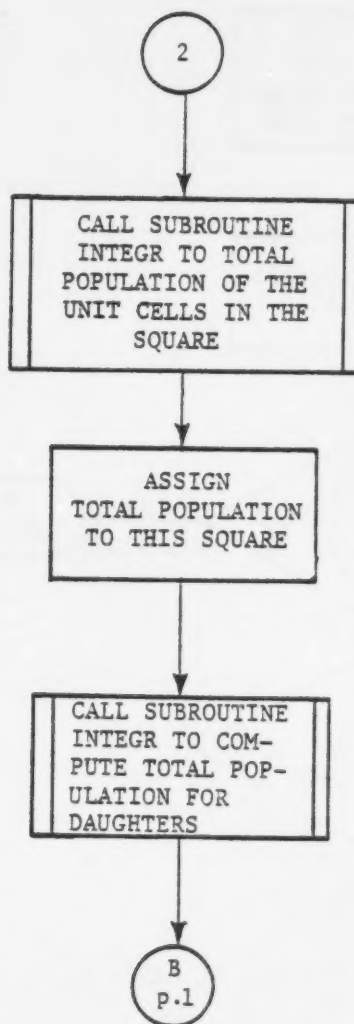


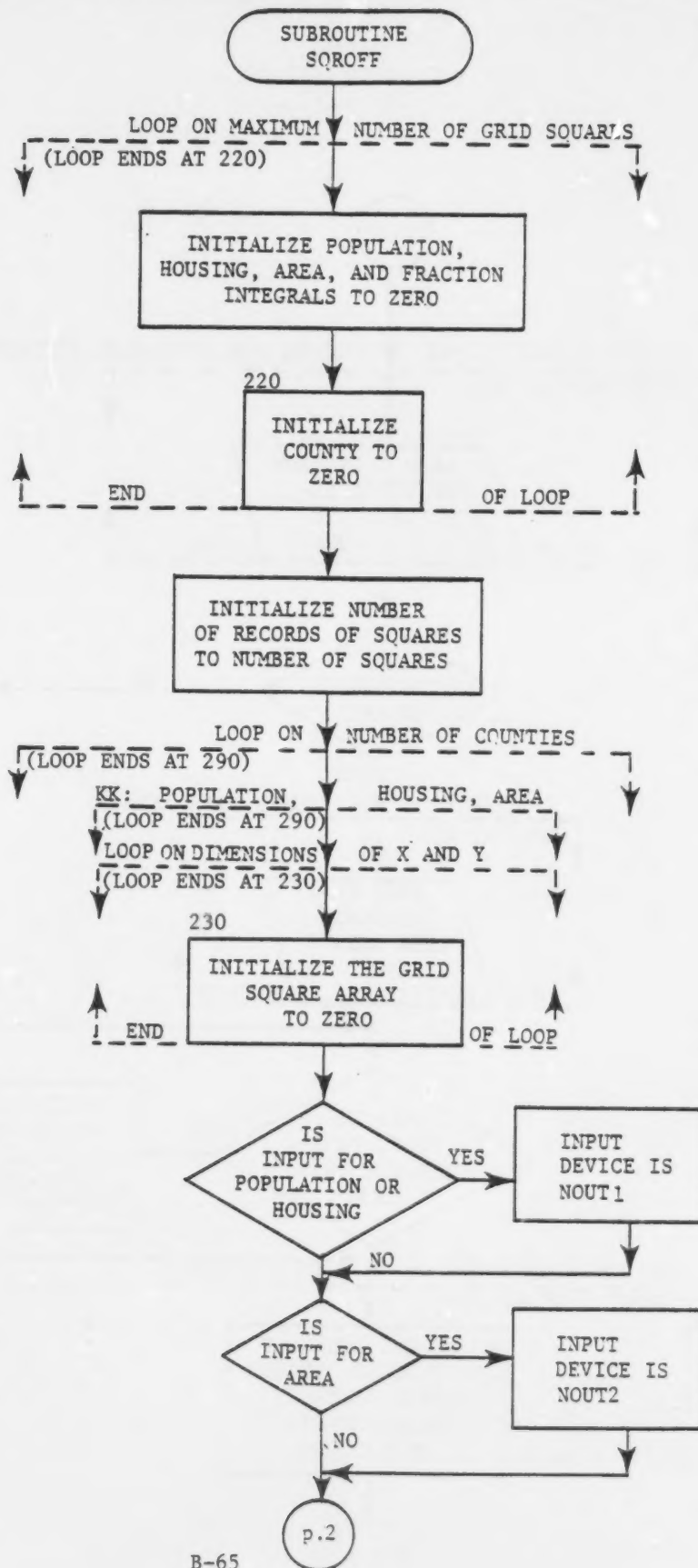


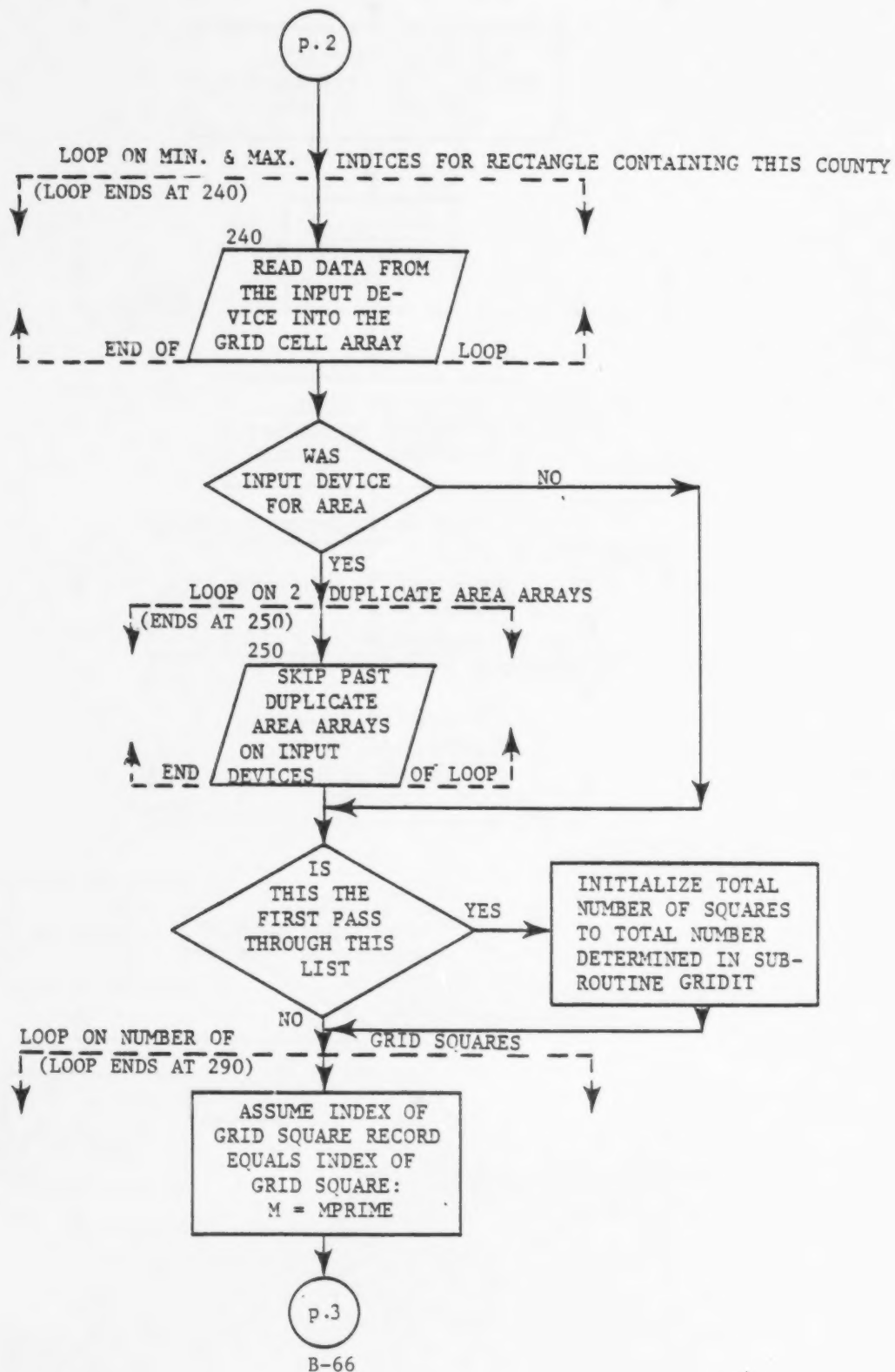


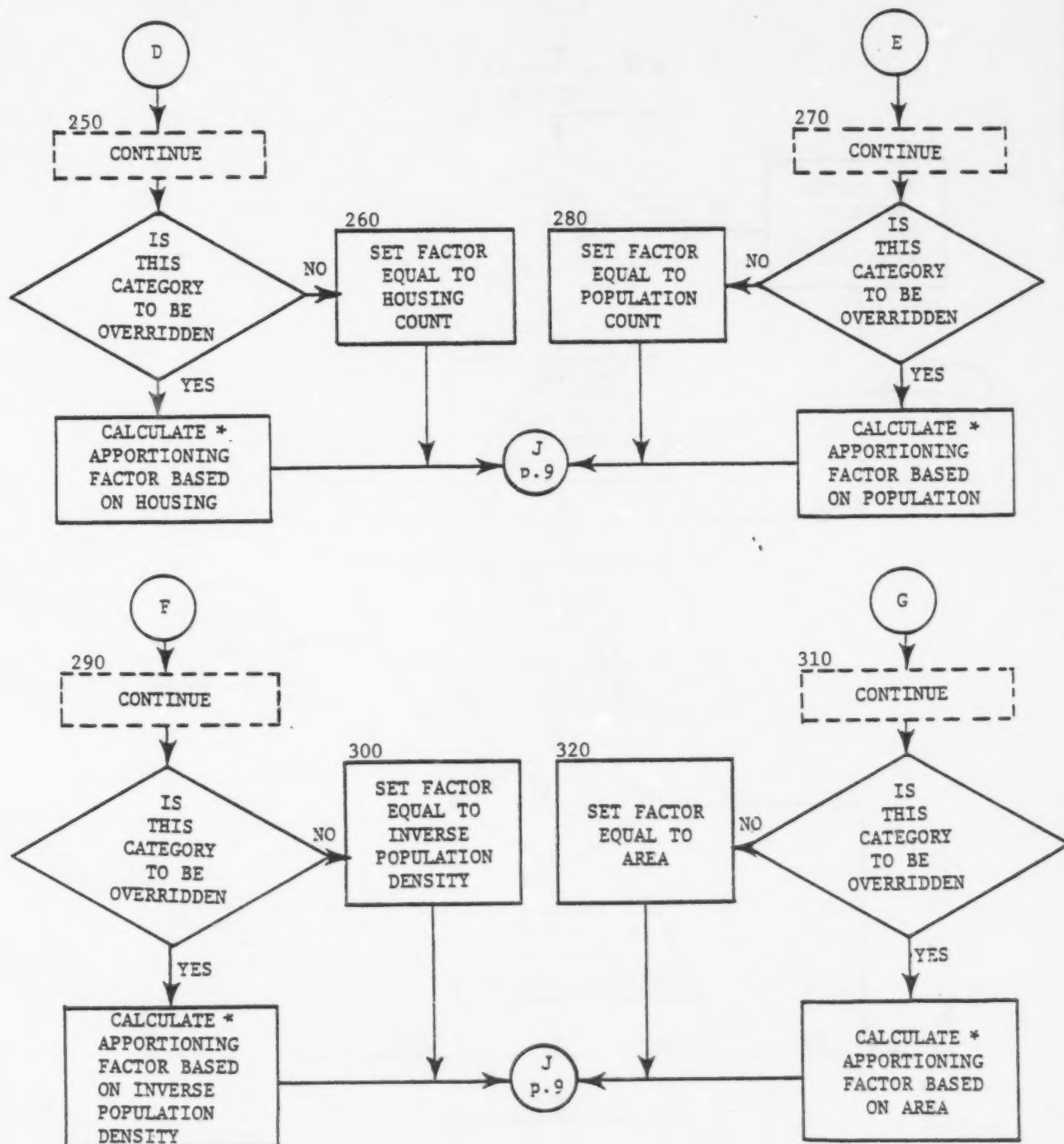




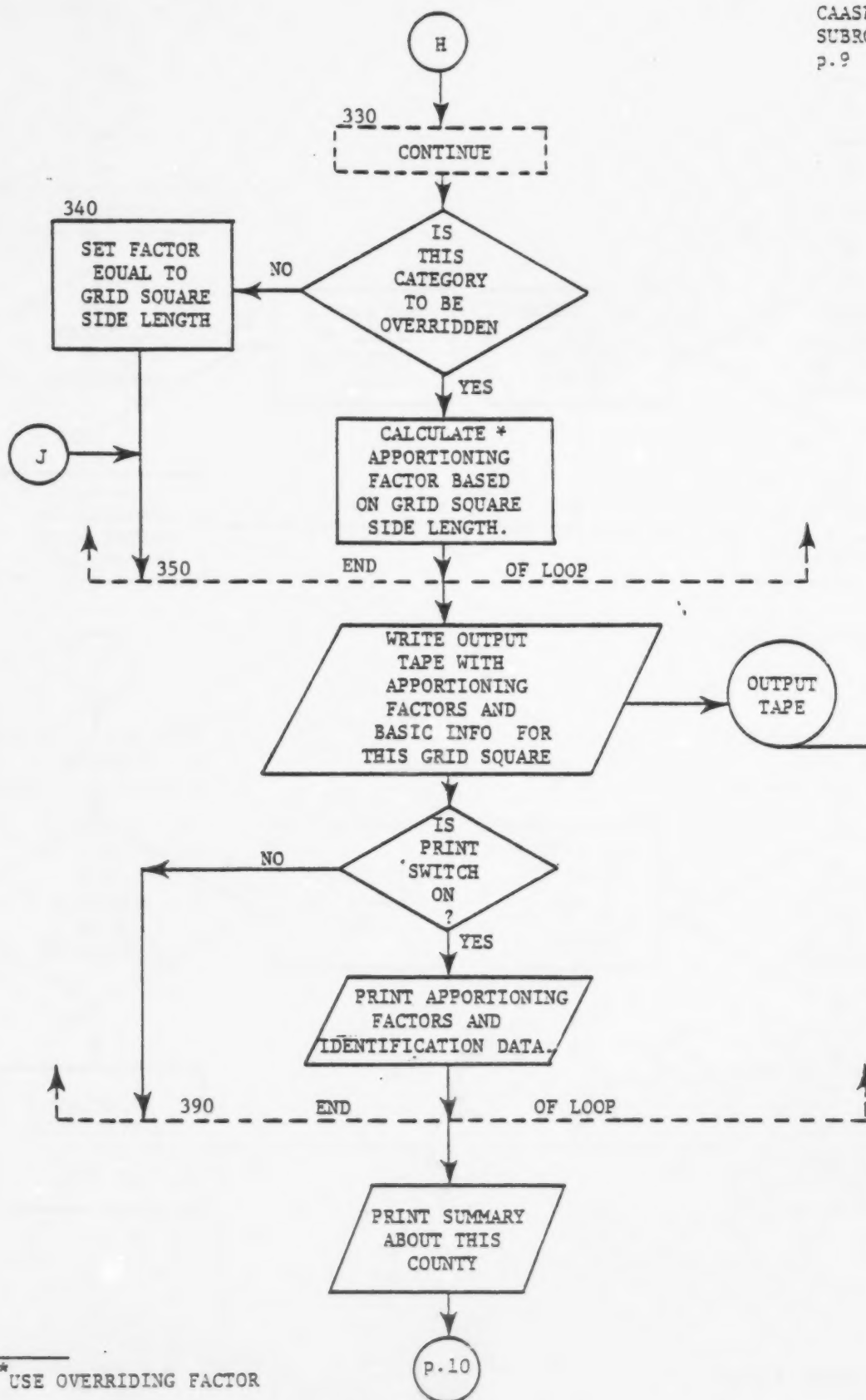




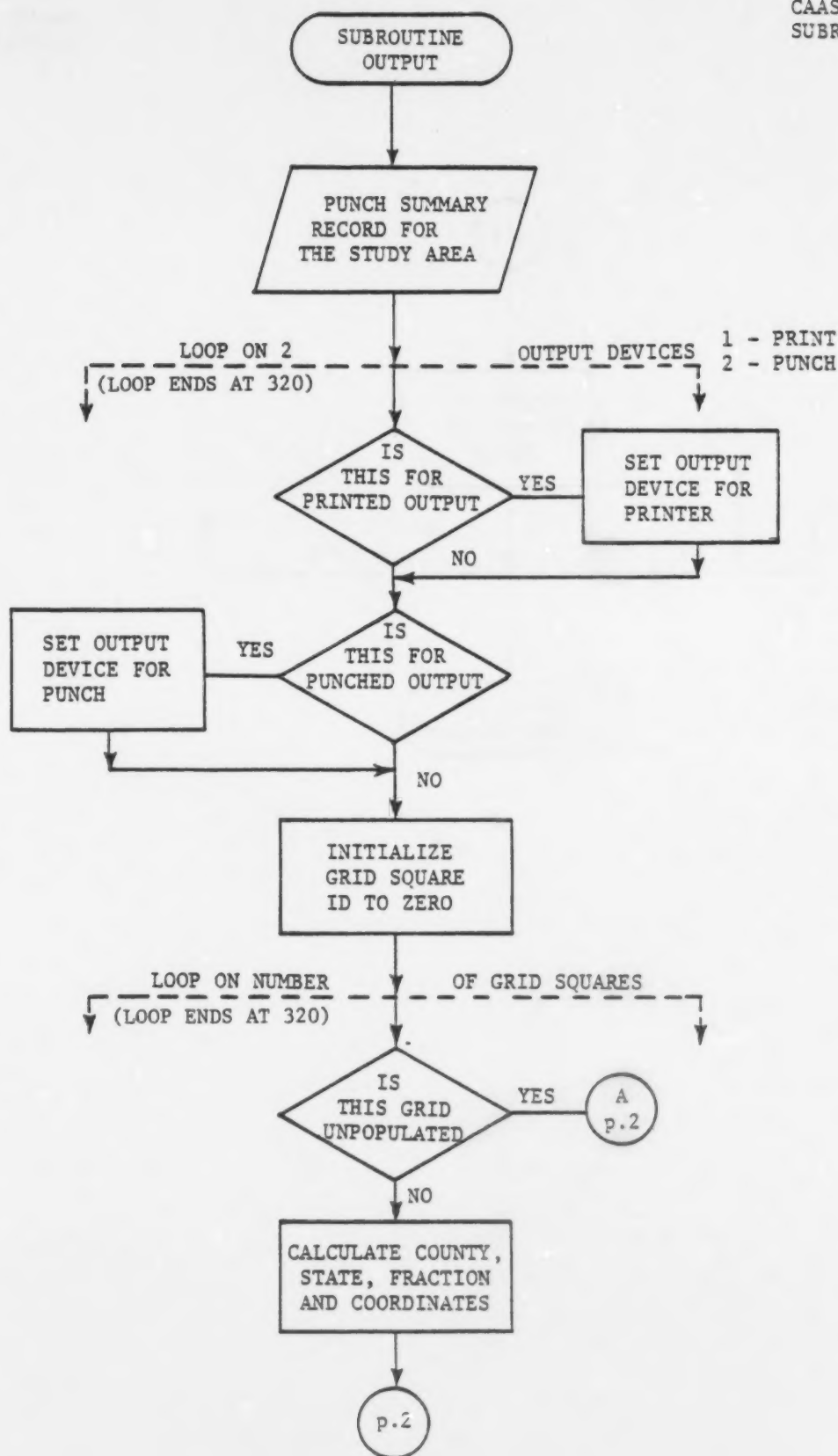


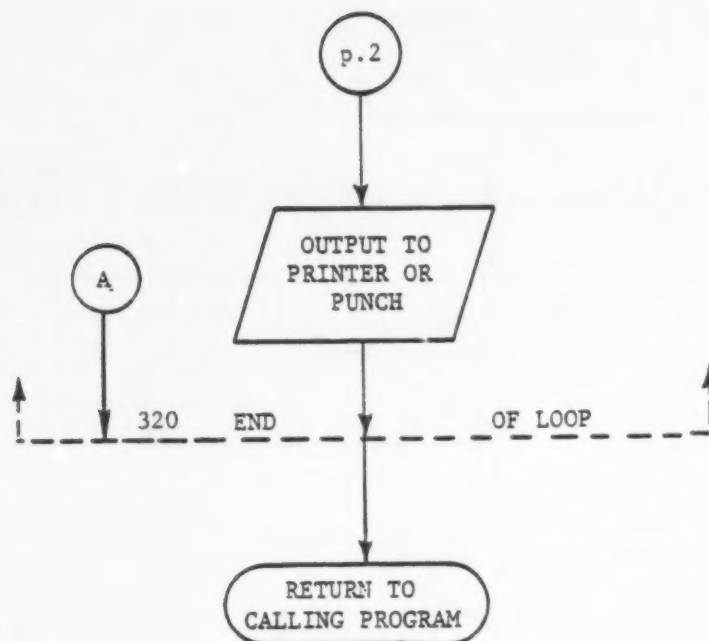


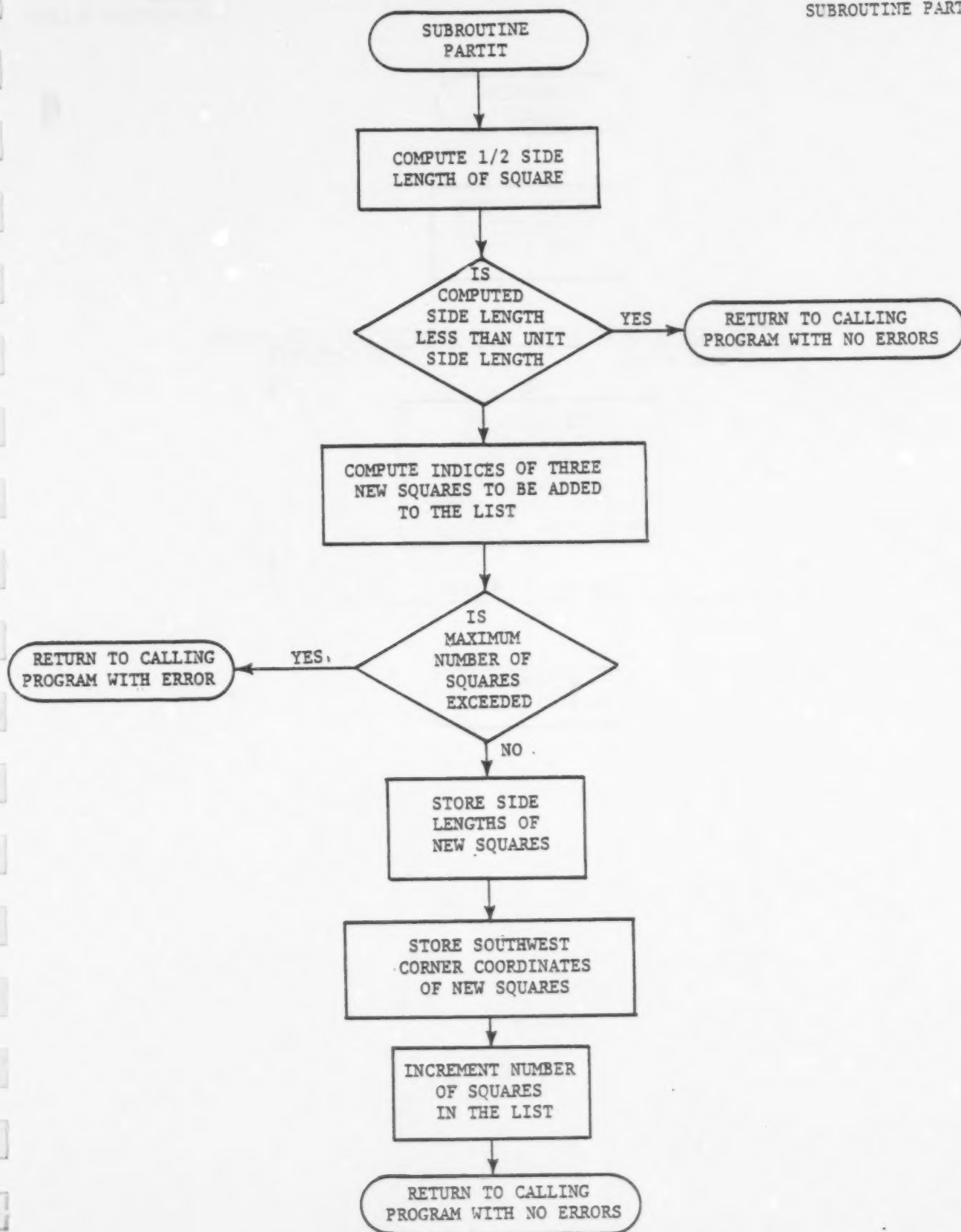
* USE OVERRIDING FACTOR

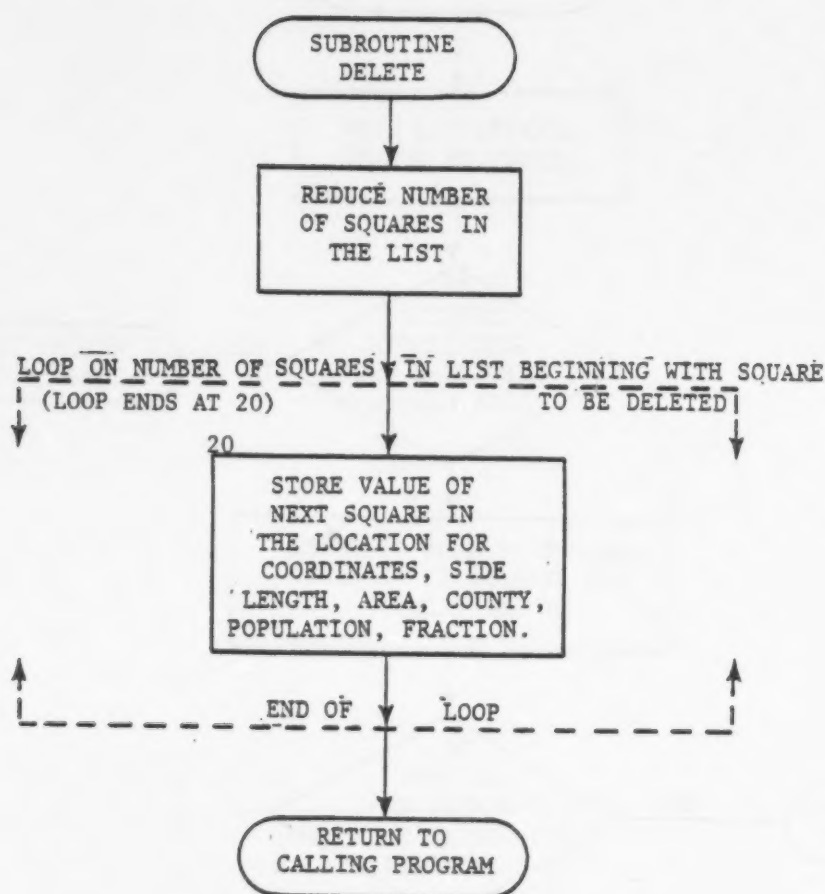


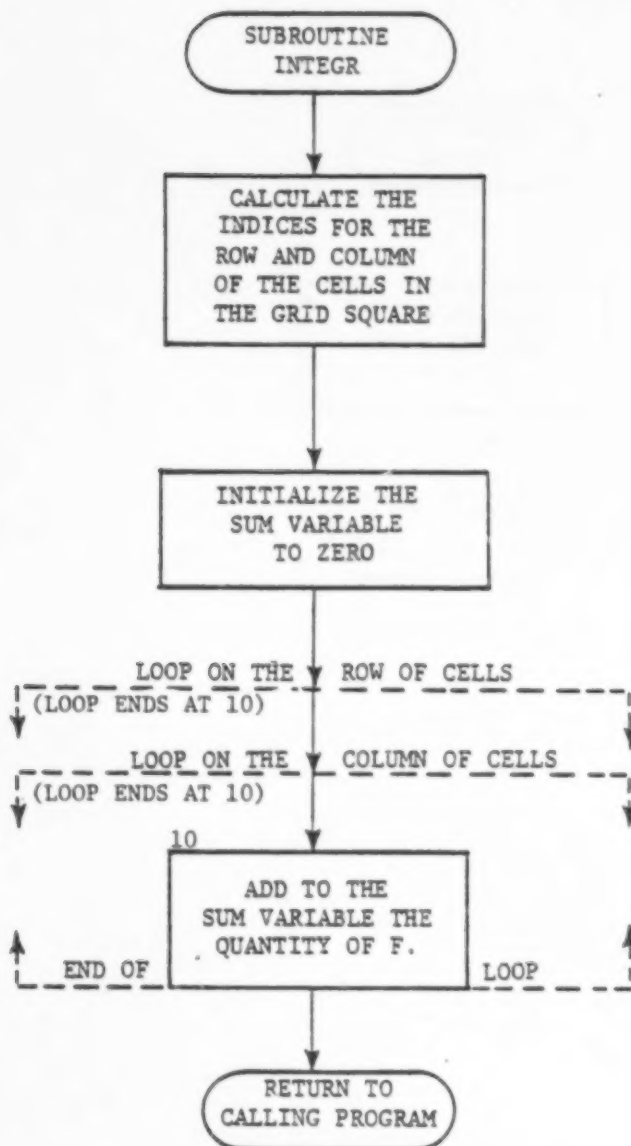
*USE OVERRIDING FACTOR

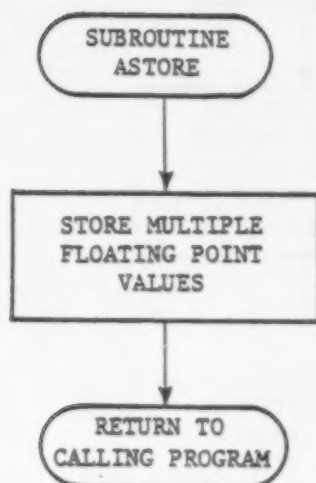


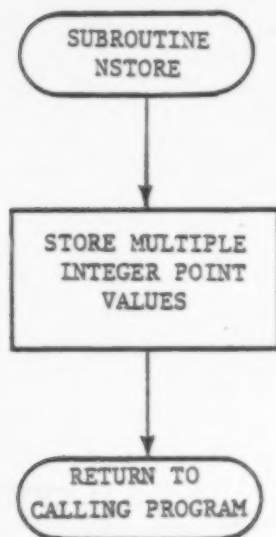


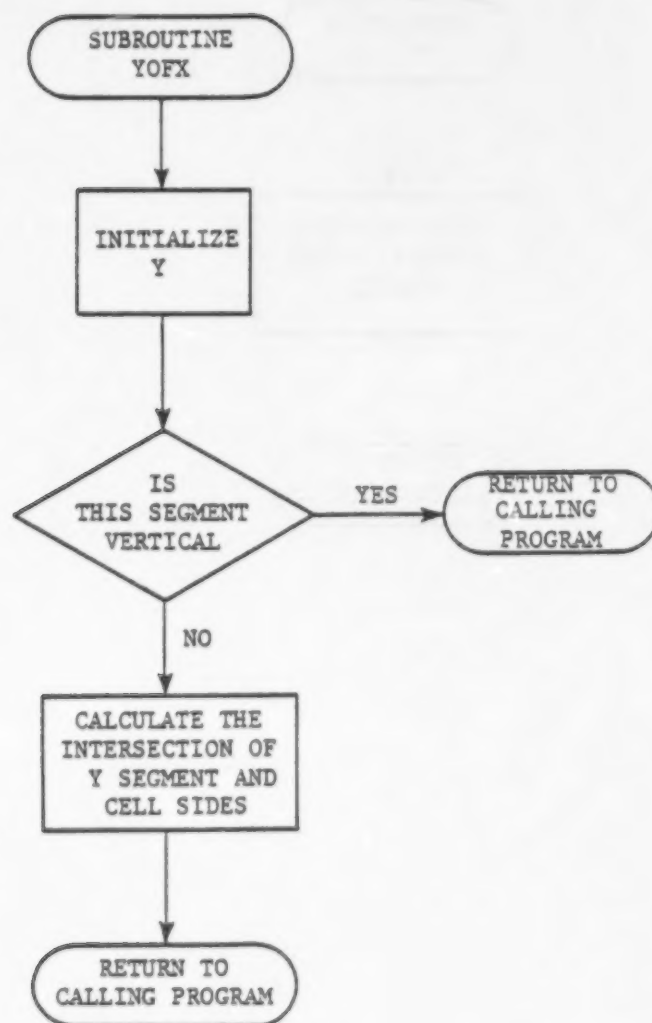


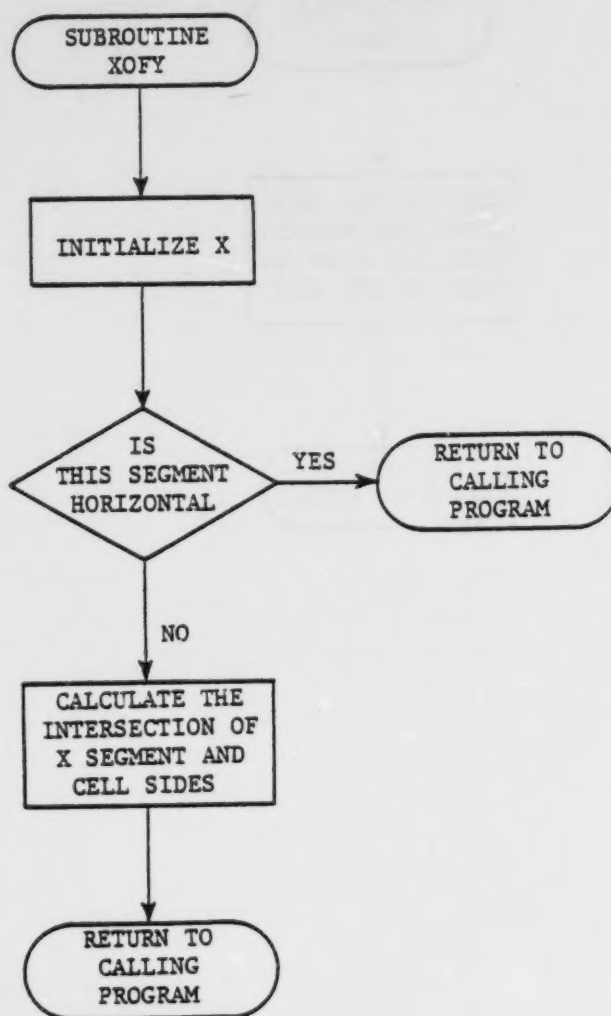


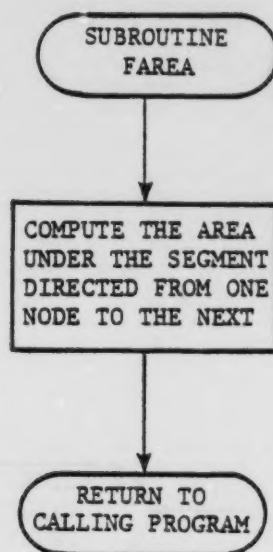


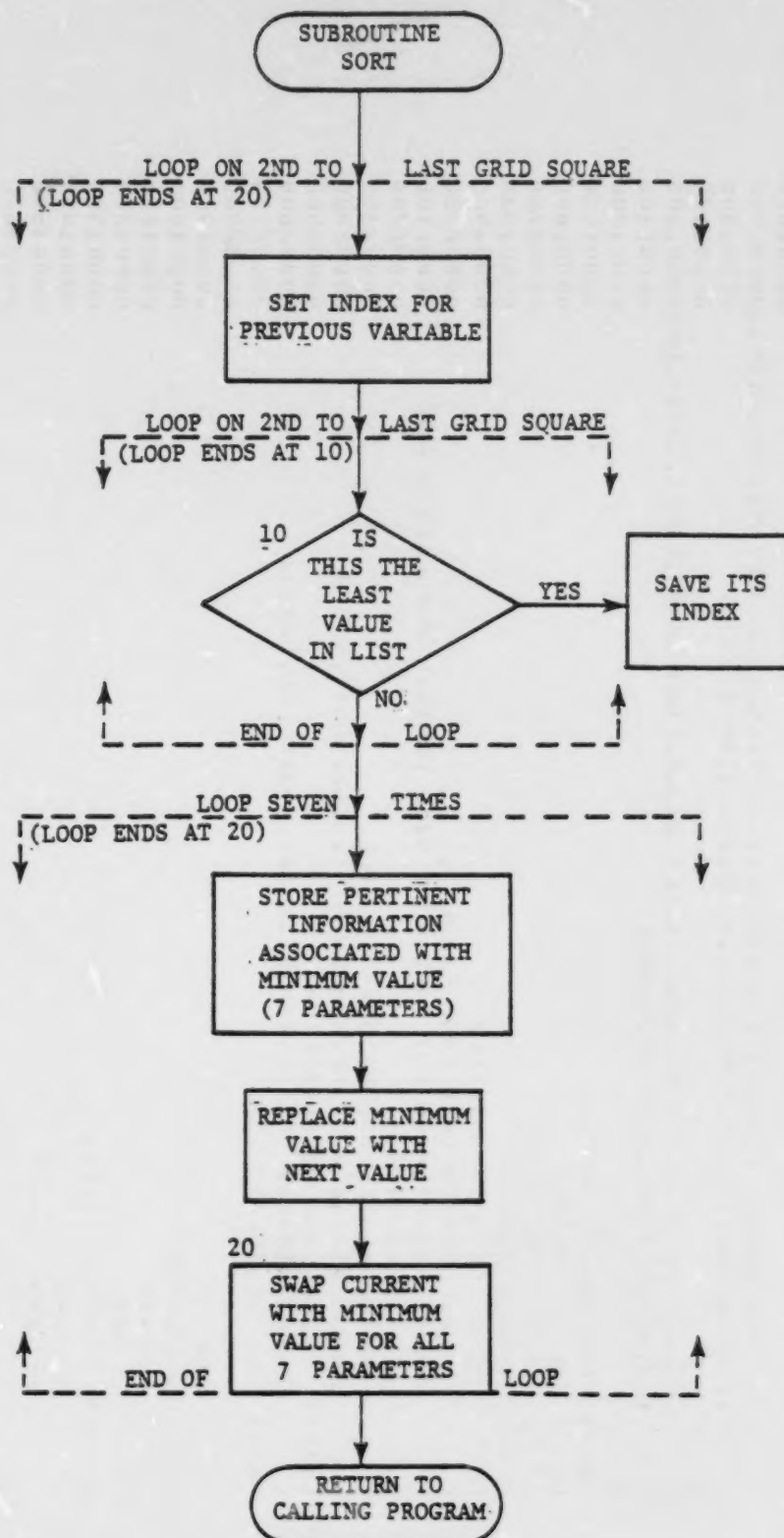













```

DIMENY=175
DIMENX=205
LIWD=52
NUMLD=2520
UNITAR=1.
ISHIFT=2**16
XMAXD=DIMENX
YMAXD=DIMENY
LPD=.0001
MAXSQR=1800
MAXTRY=5
NTRY=0

C
C READ COUNTY OUTLINES FROM DEVICE NINI. CONVERT TO UTM PRIMARY ZONE
C AND WRITE THE RESULTS ON NOUT1.
C
CALL INBOUN
READ NINI
READ NOUT1

C
C PROCESS L=1,2,...,NUMCO COUNTIES.
C
DO 50 L=1,NUMCO
  ISHIFT=IDCU(L)/1000
  ICOUNT=IDCU(L)-ISHIFT*1000
  WRITE (MP,10) L,ISTATE,ICOUNT,(CNTY(N,L),N=1,5)
  FORMAT ('X', STATECODE / COUNTY CODE / COUNTY NAME',15,18,113,5X,5A00006400
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C
C      CALL TRACKR (DIMENY,DIMENX,NUMSEG,-UNITAR,IGU,IKWIT,JGU,JKWIT,L)
C
C      AFTER TRACKER, ARRAY F(I,J) CONTAINS VALUES OF AREA:
C      = 0      IF UNIT CELL IS OUTSIDE THE BOUNDARY.
C      .LE.UNITAR  IF UNIT CELL IS ON THE BOUNDARY.
C      = UNITAR  IF UNIT CELL IS COMPLETELY INTERIOR TO BOUNDARY
C
C      PRINT THE PROXIMAL MAP OF THE COUNTY ON THE PRINTER
C
C      CALL PROXPR (DIMENY,DIMENX,IGU,IKWIT,JGU,JKWIT,0.,0.5,UNITAR)
C      WRITE (NOUT2) L,IDCU(L),IGU,IKWIT,JGU,JKWIT
C      DO 50 KK=1,3
C      DO 50 I=IGU,IKWIT
C      WRITE (NOUT2) (F(I,J),J=JGU,JKWIT)
C      READ NOUT2
C      READ NOUT1
C
C      DO 70 L=1,ndmCu
C
C      READ THE CENSUS POPULATION DATA EXTRACTED BY CAASE 1 INTO THE INTEGER
C      ARRAY NF(Y,X).  TOPOP WILL SORT THE NON-ZERO VALUES OF NF(Y,X) BY
C      ASCENDING COLUMNS BY ROWS AND PLACE IN VECTOR STORAGE.
C
C      ISTATE=IDCU(L)/1000
C      ICOUNT=IDCU(L)-ISTATE*1000
C      READ (NOUT2) LL,LD,IGU,IKWIT,JGU,JKWIT
C      WRITE (N,P,10) L,ISTATE,ICOUNT,(ONLY(N,L),N=1,5)
C
C      CALL TOPOP (DIMENY,DIMENX,IGU,IKWIT,JGU,JKWIT,TUPOP,TUHDOS,NMCNLT,
C      I,ISTATE,ICOUNT)
C
C      IF (NMCNLT.LT.NUMED) GO TO 40
C      WRITE (N,P,20) NMCNLT,NUMED
C      STOP
C
C      AFTER "TOPOP" ARRAY F(Y,X) CONTAINS VALUES OF POPULATION.

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C = POPULATION(Y,X)*2**16 + HOUSING(Y,X) IF THE UNIT CELL CENTERED ON
C (Y+UNITAR/2, X+UNITAR/2) CONTAINS ANY CENSUS ENUMERATION DISTRICT
C CENTRIDS.
C = 0 OTHERWISE.
C
C CREATE THE PROXIMAL MAP FOR THIS COUNTY
C
C CONTINUE
40 KK=1
  DO 50 I=IGU,JKWIT
    READ (NOUT2) (F(I,J),J=JGU,JKWIT)
  C
  CALL PRUXML (DIMENY,DINENX,IGU,JKWIT,JGU,JKWIT,LGU,NMCNITL)
C
C PROXML RETURNS F(Y,X) SO THAT FOR A GIVEN (Y,X), F= THE INDEX OF THE
C NEAREST CONTROL CELL.
C
C WRITE ARRAYS OF CONTAINED POPULATION AND HOUSING ON DEVICE NOUT1.
C
  WRITE (NOUT1) L,IDCU(L),IGU,JKWIT,JGU,JKWIT
  DO 70 KK=2,3
    DO 70 I=IGU,JKWIT
      READ (NOUT2) (AREAIJ(J),J=JGU,JKWIT)
      DO 60 J=JGU,JKWIT
        LL=F(I,J)
        IF (LL.EQ.0) GO TO 60
        IF (KK.EQ.2) AREAIJ(J)=POP(LL)*AREAIJ(J)
        IF (KK.EQ.3) AREAIJ(J)=HOUS(LL)*AREAIJ(J)
      C
      CONTINUE
      WRITE (NOUT1) (AREAIJ(J),J=JGU,JKWIT)
    C
    READ NOUT1
  C
  PARTITION THE MATRIX OF UNIT AREA GRID CELLS INTO SQUARES:
  C
  C INITIALIZE GRID CELL ARRAY
  DO 90 J=1,DIMENX
    DO 90 I=1,DIMENY

```

```

90      F(I,J)=0.
C
C      READ THE PROXIMAL MAPS FOR ALL COUNTIES INTO THE GRID CELL ARRAY.
DO 110 L=1,NUMCU
  READ (NOUT1) LL,IDL,IGU,IKWIT,JGU,JKWIT
  DO 100 I=IGU,IKWIT
    READ (NOUT1) (AREAIJ(J),J=JGU,JKWIT)
    DO 100 J=JGU,JKWIT
      F(I,J)=F(I,J)+AREAIJ(J)
  DO 110 I=IGU,IKWIT
110    READ (NOUT1) DUMIN
C
C      GRID CELL ARRAY F(I,J) NOW CONTAINS VALUES OF POPULATION OVER ALL
C      COUNTIES.
C
C      RETURN #10 IF THE NUMBER OF GRID SQUARES EXCEEDS THE MAX PERMISSIBLE.
C
C      RETURN #37 IF A GRID IS PROVIDED BY THE USER.
C
      CALL GRIDIT (K140,K120,DIMENY,DIMENX,FMAX,ICOUNT,TOTPOP,TOTMOS,NUM
1500)
C
C      DELETE EMPTY SQUARES AND ADJUST BOUNDARY SQUARES.
C
      CALL ADJUST (K140,NUMSUR)
C
C      INTEGRATE POPULATION, HOUSING AND AREA BY COUNTY BY GRID SQUARE:
C
120    READ NOUT1
      READ NOUT2
C
      CALL SCROFF (K140,NUMSUR)
C
C      SORT THE SQUARES BY STATE BY COUNTY BY NORTHING BY EASTING:
      CALL SORT (NUMSUR)
C
C      WRITE THE GRID SQUARE RECORDS

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C          CALL UOINPUT
C
150      WRITE (NP,130)
        FORMAT (//, ' FINISH CASE2')
        STOP
C
C #10 IN CASE NUMSQR EXCEEDS MAXSQR, INCREASE PARTITIONING THRESHOLD
C FMAX AND TRY AGAIN.
C
140      FMAX=FMAX*1.5
        IF (NTRY5.LT.MAXTRY) WRITE (NP,150) NUMSQR,MAXSQR,TMAX,FMAX
        FORMAT (//, ' THE NUMBER OF GRID SQUARES, ',16,', NOW EXCEEDS THE MAX00019800
        11000 PERMISSIBLE, ',16,', WILL PARTITION AGAIN WITH NEW FMAX, ',E00019900
        212.5, EQUAL 1.5*PREVIOUS FMAX, ',E12.5)
        NTRY5=NTRY5+1
        IF (NTRY5.LE.MAXTRY) GO TO #0
        STOP
C
        END
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C COUNTY OUTLINES TO NON-ZERO ROUT3.
C
DO 80 K=1,NSTATE
  READ (NR,10) NCNTY,(STATE(L,K),L=1,5),ICODE
  IF (NPLT.GT.0) WRITE (NPLT,10) NCNTY,(STATE(L,K),L=1,5),ICODE
  NSTART=NUNC+1
  NEND=NUNC+NCNTY
  FORMAT (14,5A4)
  WRITE (NP,40) (STATE(L,K),L=1,5),NCNTY,ICODE
  FORMAT ('0',5X,'THE STATE OF ',5A4,' HAS',14,' COUNTIES IN THE STU00004700
  10Y AREA',214)
  DO 70 I=NSTART,NEND
    READ (NR,30) IDCU(1),(CNTY(M,I),M=1,5)
    IF (NPLT.GT.0) WRITE (NPLT,30) IDCU(1),(CNTY(M,I),M=1,5)
    IDCU(1)=IDCU(1)+1000*ICODE
    WRITE (NP,50) (CNTY(M,I),M=1,5),IDCU(1)
    FORMAT ('0',COUNTY ',5A4,' HAS STATE-CNTY CODE(FIPS) ',17)
    IF (I.EQ.1) GO TO 70
    IF (IDCU(1).GT.IDCU(I-1)) GO TO 70
    *ERROR EXIT
    WRITE (NP,60)
    FORMAT ('*****ERROR***** STATE-CNTY CODES NOT IN ASCENDING',, NUM000005900
    1ERICAL ORDER')
  STOP 21
  CONTINUE
  NUNC=NUNC+NCNTY
  CONTINUE
80
C *****INITIALIZE SUMMARY VARIABLES ( ALL COUNTIES )
  GAX1=9.99E+23
  GY1=9.99E+23
  GAX2=9.99E+23
  GY2=9.99E+23
  NALL=0
  LAXL=0
  LUPRLV=0
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C*****SEARCH FOR STARTING RECORD
90 READ (NIN1,100,END=230) ID,IFE,IFN,ITE,IIN,MZONE
FE=IFE/10.
FN=IFN/10.
IE=IFE/10.
IN=IFN/10.
100 FORMAT (15,12X,215,2X,215,12)
IF (ID.LT.IDCU(1)) GO TO 90
IF (ID.EQ.IDCU(1)) GO TO 110
C *ERROR EXIT
WRITE (NP,220) IDCU(1)
STOP 23
C
C*****MAIN LOOP
C *CONVERT UTM ZONE IF NECESSARY
110 CONTINUE
C WRITE TO DEVICE NOUT3 IF .GT. 0 TO SHORTEN FUTURE TAPE READ-IN:
IF (NOUT3.GT.0) WRITE (NOUT3,100) ID,IFE,IFN,ITE,IIN,MZONE
C
C *IF NEW COUNTY PROCESS HEADER REC ,OTHERWISE REGULAR REC
C IF (ID.EQ.IDPREV) GO TO 160
C
C **PROCESS COUNTY HEADER RECORD
C *IF FIRST COUNTY,SKIP PROCESSING OF PREVIOUS COUNTY
IF (IDPREV.EQ.0) GO TO 150
C *OUTPUT PREVIOUS COUNTY'S INFO
WRITE(INXCU)=NUNSEG
150 START=INRECT+1
INRECT=INRECT+NUNSEG
ENDINRECT
120 IF (LPROB.NE.0) WRITE (NP,120) IDPREV
FORMAT (' OUTLINE SEGMENTS NOT CHAINED FOR CNTY=',I10)
IF (LPROB.NE.0) STOP 31
C *THE FOLLOWING SIX CARDS SHOULD REALLY BE INDENTED, BUT ARE'NT
IF (XL.LT.GXMIN) GXMIN=XL
IF (YL.LT.GYMIN) GYMIN=YL
IF (XN.GT.GXMAX) GXMAX=XN

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130 IF (YM,GT,GYMAX) GYMAX=YH
    WRITE (ROUT1,130) IDPREV,XL,YL,XH,YH
    WRITE (NP,130) IDPREV,XL,YL,XH,YH
    IF (NPLOT,GT,0) WRITE (NPLOT,130) IDPREV,XL,YL,XH,YH
    FORMAT (110,4F10.1)
    WRITE (ROUT1,140) ((SMX(J,1),J=1,4),I=1,START,IEND)
    WRITE (NP,140) ((SMX(J,1),J=1,4),I=1,START,IEND)
    IF (NPLOT,GT,0) WRITE (NPLOT,140) ((SMX(J,1),J=1,4),I=1,START,IEND)
    FORMAT (10X,4F10.1)
140 C *INITIALIZE FOR NEW COUNTY
150 IDPREV=ID
    HUNSLG=0
    INXCU=INXCU+1
    LPRUB=0
    PLE=-9.99E+23
    PLE=-9.99E+23
    XL=9.99E+23
    YL=9.99E+23
    XH=-9.99E+23
    YH=-9.99E+23
    GO TO 210

C
C ***PROCESS REGULAR OUTLINE RECORDS
160 HUNSEG=HUNSEG+1
    ISMA=ISMA+HUNSEG
    MOUTIX=MOUTIX-MZONE
    IF (IAS(MOUTIX).LE.1) GO TO 180
    *ERROR EXIT
    WRITE (NP,170) ID,MZONE
170 FORMAT (' ERROR:STATE-CITY=',110,'HAS BAD ZONE =',110)
180 STOP 25
    IF (MOUTIX.EQ.0) GO TO 200
    LERN=0
    XUN=MOUTIX
    IF (XUN.EQ.-1.) XOR=.0
    OFE=DOBLE(FE)
    OFN=DOBLE(FN)

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DLE=DOUBLE(TE)
DLE=DOUBLE(TN)
CALL GIGR (DTN,DLE,XOR,LEKK)
CALL GIGR (DTN,DLE,XOR,LEKK)
FE=SNGL(DLE)
FN=SNGL(DFN)
IE=SNGL(DIE)
IN=SNGL(DIN)
IF (LEKK.EQ.0) GO TO 200
  *ERROR EXIT
  WRITE (NP,190) ID
190  FORMAT (' UTM CONVERSION HAD FOR STATE-CNTY=',I10)
  STOP 26
200  CONTINUE
  IF (FE.LT.XL) XL=FE
  IF (FE.GT.XH) XH=FE
  IF (FN.LT.YL) YL=FN
  IF (FN.GT.YH) YH=FN
  IF (IE.EQ.XL.AND. TE.LT.GXMIN) ILEFT=ISMX
  SMX(1,ISMX)=FE
  SMX(2,ISMX)=FN
  SMX(3,ISMX)=TE
  SMX(4,ISMX)=TN
  *CHECK FOR HEAD TO TAIL MATCH
  IF (FE.NE.PTE.AND.PTE.NE.-9.99E+23) LPRUB=1
  IF (FN.NE.PTN.AND.PTN.NE.-9.99E+23) LPRUB=1
  *RESET PREVIOUS VALUES
  LOPREV=ID
  PTE=TE
  PTN=TN
  C
  C ***READ A NEW RECORD
210  READ (JDI,100,END=230) ID,IFE,IFN,IFE,IFN,MZONE
  FE=IFE/10.
  FN=IFN/10.
  IE=IFE/10.
  IN=IFN/10.

```

```

IF (PE.EQ.1E.AND.FIN.FO.IN) GO TO 210
IF (IWXCO.EQ.IWACO.AND.ID.NE.IDPREV) GO TO 230
IF (ID.EQ.IDPREV.OR.ID.EQ.IDCO(IWXCO+1)) GO TO 110
IF (ID.LI.IDCO(IWXCO+1)) GO TO 210
C *ERROR EXIT
WRITE (NP,220) IDCO(IWXCO+1)
220 FORMAT (' ERROR: STATE-CNTY CODE',I7,' NOT FOUND IN OUTLINE FILE')
STOP 28
C
C*****END OF FILE ACTION OR END OF REQUESTED COUNTIES ACTION
230 CONTINUE
C *OUTPUT PREVIOUS COUNTY'S INFO
IWXCO(IWXCO)=NUMSEG
ISTART=IRECT+1
IRECT=IRECT+NUMSEG
IEND=IRECT
IF (AL.LI.GXMIN) GXMIN=XL
IF (YL.LI.GYMIN) GYMIN=YL
IF (XH.LI.GXMAX) GXMAX=XH
IF (YH.LI.GYMAX) GYMAX=YH
IF (LPRUB.NE.0) WRITE (NP,120) IDPREV
IF (LPRUB.NE.0) STOP 31
WRITE (IOUT1,130) IDPREV,XL,YL,XH,YH
WRITE (NP,130) IDPREV,XL,YL,XH,YH
IF (NPLOT.GI.0) WRITE (NPLOT,140) IDPREV,XL,YL,XH,YH
WRITE (IOUT1,140) ((SMX(J,I),J=1,4),I=1,ISTART,IEND)
WRITE (NP,140) ((SMX(J,I),J=1,4),I=1,ISTART,IEND)
IF (NPLOT.GI.0) WRITE (NPLOT,140) ((SMX(J,I),J=1,4),I=1,ISTART,IEND)
C *ERROR EXIT
IF (ID.LI.IDCO(IWXCO)) WRITE (NP,220)
IF (ID.LI.IDCO(IWXCO)) STOP 29
C
C ***CALCULATE # LTED BLOCKS ETC
ASPAW=GXMAX-GXMIN
YSPAW=GYMAX-GYMIN
IX=I+IX(ASPAW/FLDAT(LTED))+1
IY=I+IY(YSPAW/FLDAT(LTED))+1

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```

LXIRAX=(LX*LTWU-XSPAN)/2.0
LXIRAY=(LY*LTWU-YSPAN)/2.0
NXURIG=LX*MIU-EXIRAX
NYURIG=LY*MIN-EXIRAY
XURIG=NXURIG
YURIG=NYURIG
      RETURN
      C
      C
      END

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00022300
00022400
00022500
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00022700
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00022900
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00023100
00023200

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YMAX=YMAX-YORIG
WRITE (NP,50) LD,XMIN,YMIN,XMAX,YMAX
NUMSEG=IRECO(LN)
DO 10 I=1,NUMSEG
  READ (NOUT1,40) X1(M),Y1(M),X2(M),Y2(M)
  X1(M)=X1(M)-XORIG
  Y1(M)=Y1(M)-YORIG
  X2(M)=X2(M)-XORIG
  Y2(M)=Y2(M)-YORIG
  WRITE (NP,101) M, X1(M),Y1(M),X2(M),Y2(M)
  CONTINUE
  C
10  C
  WRITE (NP,101) NUMSEG
  IGO=YMIN-1
  IF (IGO,LE,0) IGO=1
  IJW1=YMAX+1
  IF (IJW1,GT,DIMENY) IJW1=DIMENY
  JGU=XMIN-1
  IF (JGU,LE,0) JGU=1
  IJW1=XMAX+1
  IF (IJW1,GT,DIMENX) IJW1=DIMENX
  DO 20 J=JGU,IJW1
    DO 20 I=IGO,IJW1
      AREA(1,J)=0.
  20  FORMAT (110,4F10.1)
  30  FORMAT (10X4F10.1)
  40  C
  C TEST DIRECTIONALITY:
  C
  AREA=0.
  DO 50 L=1,NUMSEG
    AX=X1(L)
    AY=Y1(L)
    AX2=X2(L)
    AY2=Y2(L)
    I=FAREA(AX,AY,AX2,AY2)
    AVGY=(Y1(L)+Y2(L))/2.
    VELDY=AX2(L)-X1(L)

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C      PRINT 5560, L, TAREA, I, AVGY, DELDX, X1(L), Y1(L), X2(L), Y2(L)
50      TAREA=TAREA+I
      WRITE (NP,60) (CHTY(MM,LM), MM=1,5), TAREA
60      FORMAT ('/' TRACKER COMPUTES TOTAL AREA OF ',5A4,' COUNTY AS :',E12.
14)
C
C      IF SIGN OF AREA IS NOT NEGATIVE, I.E. IF DIRECTION IS NOT COUNTER-
C      CLOCKWISE, REORDER THE SEGMENTS AND NODES:
C
      IF (TAREA.LT.0.) GO TO 80
      CALL REURDR (NUMSEG,X1,Y1,X2,Y2)
      TAREA=0.
      DO 70 L=1,NUMSEG
      AX=X1(L)
      YY=Y1(L)
      X=X2(L)
      Y=Y2(L)
      T=TAREA+(XX*YY-X*Y)
      TAREA=TAREA+T
      WHILE (NP,60) (CHTY(MM,LM), MM=1,5), TAREA
70
C      XENIER=2.*XMAXD
80      YENIER=2.*YMAXD
C      INITIALIZE COUNTERS
C
      ISIDE=0
      IEXI=0
      IENIER=0
      FIRSTIME.TRUE.
C
C      'L' COUNTS SEGMENTS
C      L=0
90      L=L+1
      IF (L.GT.NUMSEG) GO TO 140
      AX=X1(L)
      YY=Y1(L)
      JI=X1(L)+1.0

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11=Y1(L)+1.0
DELX=X2(L)-X1(L)
DELY=Y2(L)-Y1(L)
IF (LM.GE.7.AND.L.EQ.34) PRINT 100, L,I1,J1,DELX,DELY
FORMAT (/ ' 2 L I1 J1 DELX DELY' /3I5,2F10.4)
100 X1=X1-1
110 X2=X2+1
XP=X1
YM=Y1-1
YP=Y1
IF (LM.GE.7.AND.L.EQ.34) PRINT 120, L,J1,XM,XP,I1,YM,YP
FORMAT (/ ' 3 L' ,I5,2(I5,2F10.2))
120 C
C TEST SEGMENT FROM (XX,YY) TO (X2(L),Y2(L)) FOR INTERSECTION (X,Y)
C WITH SIDES OF CELL (I1,J1).
C IF THE TERMINUS OF THE SEGMENT IS INSIDE THE CELL, (X,Y) WILL BE
C RETURNED EQUAL TO (X2(L),Y2(L)).
C
X2L=X2(L)
Y2L=Y2(L)
CALL SIDEIT (XM,XP,YM,YP,XX,YY,X2L,Y2L,X,Y,ISIDE,NUM,SIDE)
C
C COMPUTE THE AREA IN CELL (I1,J1) CONTAINED BY THE SEGMENT FROM
C (XX,YY) TO (X,Y)
C
AREA(I1,J1)=AREA(I1,J1)+FAREA(XX,YY,X,Y)
IF (LM.GE.7.AND.L.EQ.34) PRINT 130, L,I1,J1,IENTER,XENTER,YENTER,
130 IEXIT,XX,YY,X,Y,AREA(I1,J1),NUM,SIDE
FORMAT (/ ' L I1 J1 IENTER XENTER YENTER IEXIT XX YY X Y AREA'
140 NUM SIDE' /,4I4,2F10.4,I4,5F10.4,/,15,406)
C
C CURRENT TERMINUS IS NEXT ORIGIN
C
AREA
YY=Y
C
C IF NO SIDE WAS INTERSECTED, INCREMENT TO THE NEXT SEGMENT.
C IF (NUM.EQ.0) GO TO 90
C
C COMPUTE THE ENCLOSED AREA FROM EXIT NODE TO ENTRY NODE:

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C
140 IEXIT=ISIDE
    AAREA=AREA(11,J1)
    CALL WRAPUP (ISIDE,X,Y,IENTER,XENTER,YENTER,XM,YM,XP,YP,AAREA)
    IF (IENTER.NE.0) CALL NEIBAL (AAREA,UNITAR)
    AREA(11,J1)=AAREA
C
C A TRICK TO FLAG BOUNDARY CELLS WITH CONTAINED AREA EQUAL TO
C UNITAR TO DISTINGUISH BOUNDARY CELLS FROM INTERIOR CELLS.
    IF (AREA(11,J1).EQ.UNITAR) AREA(11,J1)=.999*UNITAR
    IF (LM.GE.7.AND.L.EQ.34) PRINT 150, L,11,J1,IENTER,XENTER,YENTER,I00015900
    IEXIT,XX,YY,X,Y,AREA(11,J1),NUM,SIDE
C
C HAVE ALL COUNTY OUTLINE SEGMENTS BEEN PROCESSED?
    IF (L.GT.NUMSEG) GO TO 210
C
C DETERMINE NEXT CELL TO TRACK TO.
C
    ALNENTER=X
    YENTER=Y
    IF (LM.GE.7.AND.L.EQ.34) PRINT 150, L,11,J1,IENTER,IEXIT
    150 FORMAT (/,'9 WRAPUP L,11,J1,IENTER,IEXIT',5I5)
C
C TEST FOR PROCESSING NEXT SEGMENT = COINCIDENCE OF TERMINAL NODE
C AND EXIT NODE = WITHIN EPS OF EACH OTHER.
    IF (ABS(X2(L)-X).LT.EPS.AND.ABS(Y2(L)-Y).LT.EPS) L=L+1
C
    IF (L.LE.NUMSEG) CALL ASTORE (X160,DELX,X2(L)-X,DELY,Y2(L)-Y,D,D,D00017500
    1,D)
    IF (L.GT.NUMSEG) CALL ASTORE (X160,DELX,X2(1)-X,DELY,Y2(1)-Y,D,D,D00017800
    1,D)
    160 CALL DECIDE (NUM,STORE,DELX,DELY,JDEL,IDEL,IENTER)
    JEXIT=J1+JDEL
    IEXIT=I1+IDEL
    IF (LM.GE.7.AND.L.EQ.34) PRINT 170, L,IEXIT,JNEXT,IENTER,IEXIT
    170 FORMAT (/,'L IEXIT JNEXT IENTER IEXIT',5I4)
C

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```

C DETERMINE CELLS INTERIOR AND EXTERIOR TO (I1,J1)--(INEXT,JNEXT)
C ON CELL ROW I1.
C
    IF (JDEL.EQ.0.AND.IDEL.EQ.0) GO TO 180
    CALL INTRIOR (DIMENY,DIMENX,I1,J1,IDEL,JDEL,JGO,JKWIT,UNITAR,IGO,IK
    INIT)
    FIRSTM=.TRUE.
    IF (LM.GE.7.AND.L.EQ.34) PRINT 190, I1,J1,(AREA(I1,KJ)),KJ=JGO,JKW
    IT)
    IF (AREA(I1,J1).GT.UNITAR.AND.AREA(I1,J1).LT.0.) FIRSTM=.FALSE.
    I1=INEXT
    J1=JNEXT
    190 FORMAT (1X2I4,20F6.3,10(/9X20F6.5))
    IEXTI=0
    ISIDE=0
    IF (LM.GE.7.AND.L.EQ.34) PRINT 200, L,I1,J1
    200 FORMAT (/,' GOING TO 3 L I1 J1',3I5)
    C PROCESS NEXT CELL
    IF (L.LE.NUMSEG) GO TO 110
    IF (L.GT.NUMSEG) GO TO 140
    C
    C 100 = HAVE FINISHED TRACK FOR THIS COUNTY.
    C
    C MAKE FINAL DETERMINATION OF CELLS EXTERIOR TO BOUNDARY CELLS AND
    C CONVERT NEGATIVE AREA VALUES TO POSITIVE.
    210 CALL FINAL (DIMENY,DIMENX,UNITAR,IGO,IKWIT,JGO,JKWIT)
    C
    C RETURN
    C
    END

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SUBROUTINE REORDR (NUMSEG,X1,Y1,X2,Y2)
DIMENSION X1(20), Y1(20), X2(20), Y2(20)
MID=(NUMSEG+1)/2
I=1
J=NUMSEG
DO 10 L=1,MID
S1=X1(I)
S2=Y1(I)
S3=X2(I)
S4=Y2(I)
X1(I)=X2(J)
Y1(I)=Y2(J)
X2(I)=X1(J)
Y2(I)=Y1(J)
X2(J)=S1
Y2(J)=S2
X1(J)=S3
Y1(J)=S4
I=I+1
J=J-1
RE TURN
END

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C

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C SUBROUTINE SIDEIT (XM,XP,YN,YP,X1,Y1,X2,Y2,X,Y,ISIDE,NUM,SIDE)
C
C 'SIDEIT' IS CALLED BY 'TRACKR' TO FIND INTERSECTIONS OF SEGMENTS
C AND CELL SIDES TO DETERMINE COORDINATES OF THE POINT WHERE THE
C COURT boundary LEAVES THE CELL.
C SUBROUTINES USED:
C SUBROUTINE YOFX
C SUBROUTINE XOFY
C SUBROUTINE NSTORE
C
C LOGICAL SIDE(4)
C
C COMMON /IPARM/ UNITAR,ISHIFT,XMAXD,YMAXD,EPS
C
C XMIN=AMIN1(X1,X2)
C XMAX=AMAX1(X1,X2)
C YMIN=AMIN1(Y1,Y2)
C YMAX=AMAX1(Y1,Y2)
C
C TEST SEGMENT L FOR INTERSECTION WITH SIDES OF CELL (II,J1)
C INITIALIZE COORDINATES OF INTERSECTION, THE SIDE NUMBER AND
C THE NUMBER OF SIDES INTERSECTED. TWO SIDES INTERSECTED MEANS
C LEAVING THE CELL THROUGH A CORNER.
C
C X=X2
C Y=Y2
C ISIDE=0
C LNUM=0
C
C TEST FOR TERMINAL NODE (X2,Y2) THIS SEGMENT BEING STRICTLY
C INTERIOR TO THIS CELL AND THEREFORE NO INTERSECTION.
C IF (X2.GT.XM.AND.X2.LT.XP.AND.Y2.GT.YM.AND.Y2.LT.YP) RETURN
C
C TEST FOR INTERSECTIONS WITH SIDES 1 & 3. SOLVE FOR Y WITH X=XM
C THEN WITH X=XP.
C X=XM
C DO 10 KSIDE=1,3,2

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SIDE(KSIDE)=.FALSE.
C
C FIND Y COORDINATE OF INTERSECTION OF SEGMENT AND THE SIDE NUMBER
C 'KSIDE'.
C
C CALL YOFX (XB,X1,Y1,X2,Y2,YB)
C
C IS THE Y-COORDINATE OF INTERSECTION ON THE SIDES OF THE CELL?
C
C IF ((YP-YB)+EPS.GT.0..AND.(YB-YM)+EPS.GT.0..AND.(XMAX-XB)+EPS.GT.000004700
C 1..AND.(XB-XMIN)+EPS.GT.0..) SIDE(KSIDE)=.TRUE.
C THE ENTRY NODE IS AN UNWANTED POSSIBLE SOLUTION.
C
C IS THE POINT OF INTERSECTION THE ENTRY POINT?
C
C IF (ABS(XB-X1).LT.EPS.AND.ABS(YB-Y1).LT.EPS) SIDE(KSIDE)=.FALSE.
C IF (.NOT.SIDE(KSIDE)) GO TO 10
C
C GO TO NEXT SIDE AND TEST IT FOR INTERSECTION.
C
C
C ISIDE=KSIDE
C Y=YB
C A=XB
C IUM=NUM+1
C AB=XP
C
C 10
C TEST FOR INTERSECTION WITH SIDES 2 AND 4. SOLVE FOR X WITH Y=YM THEN
C Y=YP.
C
C
C Y=YM
C DO 20 KSIDE=2,4,2
C SIDE(KSIDE)=.FALSE.
C CALL XOFY (YA,X1,Y1,X2,Y2,XA)
C IF ((XP-XA)+EPS.GT.0..AND.(XA-XM)+EPS.GT.0..AND.(YMAX-YA)+EPS.GT.000007100
C 1..AND.(YA-YM)+EPS.GT.0..) SIDE(KSIDE)=.TRUE.
C THE ENTRY NODE IS AN UNWANTED POSSIBLE SOLUTION.
C IF (ABS(XA-X1).LT.EPS.AND.ABS(YA-Y1).LT.EPS) SIDE(KSIDE)=.FALSE.

```

```

20 IF (.NOT.SIDE(KSIDE)) GO TO 20
C   ISIDE=KSIDE
C   X=XA
C   Y=YA
C   NUM=NUM+1
C   YA=YP
C
C   IF (NUM.GT.0) RETURN
C   IF NO INTERSECTIONS THE SEGMENT (X1,Y1) TO (X2,Y2) MAY BE
C   COINCIDENT WITH A SIDE OF THE CELL AND (X2,Y2) MAY BE ON A
C   SIDE.
C
C   ARE WE ON A VERTICAL SIDE?
C
C   IF (ABS(X2-X1).GT.EPS) GO TO 40
C   IF (X2.EQ.XM.AND.(Y2.LE.YP.AND.Y2.GE.YM)) SIDE(1)=.TRUE.
C   IF (SIDE(1)) CALL NSTORE (&30,ISIDE,1,NUM,NUM+1)
C   IF (X2.EQ.XP.AND.(Y2.LE.YP.AND.Y2.GE.YM)) SIDE(3)=.TRUE.
C   IF (SIDE(3)) CALL NSTORE (&40,ISIDE,3,NUM,NUM+1)
C
C   ARE WE ON A HORIZONTAL SIDE?
C
C   IF (ABS(Y2-Y1).GT.EPS) GO TO 60
C   IF (Y2.EQ.YM.AND.(X2.LE.XP.AND.X2.GE.XM)) SIDE(2)=.TRUE.
C   IF (SIDE(2)) CALL NSTORE (&50,ISIDE,2,NUM,NUM+1)
C   IF (Y2.EQ.YP.AND.(X2.LE.XP.AND.X2.GE.XM)) SIDE(4)=.TRUE.
C   IF (SIDE(4)) CALL NSTORE (&60,ISIDE,4,NUM,NUM+1)
C   IF (NUM.GT.0) RETURN
C
C   NO SIDES INTERSECTED AND TERMINAL NODE OF SEGMENT NOT INTERIOR TO
C   CELL. SEGMENT MAY ORIGINATE ON A CELL SIDE AND BE DIRECTED AWAY FROM
C   THE CELL.
C
C   IF (ABS(Y1-YM).LT.EPS) SIDE(2)=.TRUE.
C   IF (ABS(X1-XM).LT.EPS) SIDE(1)=.TRUE.
C   IF (ABS(Y1-YP).LT.EPS) SIDE(4)=.TRUE.
C   IF (ABS(X1-XP).LT.EPS) SIDE(3)=.TRUE.

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DU /0 KSIDE=1,4
IF (SIDE(KSIDE)) CALL NSTORE (&/0, ISIDE, KSIDE, NUM, NUM+1)
CONTINUE
IF (NUM.EQ.0) RETURN
X=X1
Y=Y1
RETURN
END

70

C


```

C BEGIN AT THE EXIT NODE:
C
C INITIALIZE (X1,X2), (Y1,Y2) FOR EXIT ON SIDE 1
C IF (ISIDE.EQ.1) CALL ASTORE (X30,X1,XOUT,Y1,YOUT,X2,XM,Y2,YM)
C INITIALIZE (X1,X2), (Y1,Y2) FOR EXIT ON SIDE 3
C IF (ISIDE.EQ.3) CALL ASTORE (X30,X1,XOUT,Y1,YOUT,X2,XP,Y2,YP)
C INITIALIZE (X1,X2), (Y1,Y2) FOR EXIT ON SIDE 2
C IF (ISIDE.EQ.2) CALL ASTORE (X30,X1,XOUT,Y1,YOUT,X2,XP,Y2,YM)
C INITIALIZE (X1,X2), (Y1,Y2) FOR EXIT ON SIDE 4
C IF (ISIDE.EQ.4) CALL ASTORE (X30,X1,XOUT,Y1,YOUT,X2,XM,Y2,YP)
C
C EXIT SIDE AND ENTRY SIDE MAY BE THE SAME SIDE.
C
30 IF (CENTER.NE.IOUT) GO TO 130
C
C ENTRY AND EXIT SIDES ARE THE SAME SIDE.
C
C THE AREA UNDER SEGMENTS ON SIDES 1 OR 3 IS ZERO; RETURN TO CALLING
C PROGRAM WITHOUT ADDING TO CUMULATIVE AREA OF THE CURRENT CELL.
C
GO TO (40,50,60,70), ISIDE
IF (YOUT.LT.YENTER) GO TO 130
RETURN
IF (XOUT.GT.XENTER) GO TO 130
FINISH=.TRUE.
TEMPARE=FAREA(XOUT,YOUT,XENTER,YENTER)
GO TO 140
IF (YOUT.GT.YENTER) GO TO 130
RETURN
IF (XOUT.LT.XENTER) GO TO 130
TEMPARE=FAREA(XOUT,YOUT,XENTER,YENTER)
FINISH=.TRUE.
GO TO 140
C
C
C TRAVEL TO THE NEXT SIDE AFTER ISIDE HAS BEEN INCREMENTED 1.
C THE AREA UNDER SEGMENTS ON SIDES 1 OR 3 IS ZERO. BRANCH PAST THE

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00007100
00007200
00007300
00007400

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```

C CUMULATIVE SUM AT STATEMENT 20
C
80 GU TO (90,100,110,120), ISIDE
90 CALL ASIORE (&150,X1,X2,Y1,Y2,X2,XM,Y2,YM)
100 CALL ASIORE (&130,X1,X2,Y1,Y2,X2,XP,Y2,YM)
110 CALL ASIORE (&150,X1,X2,Y1,Y2,X2,XP,Y2,YP)
120 CALL ASIORE (&130,X1,X2,Y1,Y2,X2,XM,Y2,YP)
C
C 19 = COMPUTE AREA CONTAINED BY SEGMENT FROM (X1,Y1) TO (X2,Y2)
C
130 IMPARE=FAREA(X1,Y1,X2,Y2)
C
C ADD AREA CONTAINED BY SEGMENT TO AREA CONTAINED IN THIS CELL:
C
140 AREA=AREA+IMPARE
150 CONTINUE
C PRINT 1000,ISIDE,X1,Y1,X2,Y2,IMPARE,AREA
C 1000 FURMAT(10X13,5F10.2,F10.4)
C IF (FINISH) RETURN
C
C ADVANCE TO NEXT SIDE:
C
ISIDE=MOD(ISIDE,4)+1
IF (ISIDE.NE.IENTER) GO TO 80
FINISH=.TRUE.
CALL ASIORE (&130,X1,X2,Y1,Y2,X2,XENTER,Y2,YENTER)
C
C NET BALANCE COMPUTATION ON CONTAINED AREA OF CELL.
C
ENTRY NETBAL (AREA,UNITAR)
IF (AREA.GE.UNITAR) RETURN
AREA=AREA-UNITAR
GO TO 160
C
160
C
END

```



```

90      IF (SIDE(1)) CALL NSTORE (8100,JDEL,JINC(1,J),IENTER,ENTER3(I,J)) 00003800
      IF (SIDE(2)) CALL NSTORE (8100,IDEL,IINC(1,J),IENTER,ENTER4(I,J)) 00003900
      IF (SIDE(3)) CALL NSTORE (8100,JDEL,JINC(1,J)+1,IENTER,ENTER3(I,J))00004000
      1) 00004100
      IF (SIDE(4)) CALL NSTORE (8100,IDEL,IINC(1,J)+1,IENTER,ENTER4(I,J))00004200
      1) 00004300
      RETURN 00004400
      C      00004500
      END 00004600

```



```

60 IF (AREA(II,J1).EQ.0.) AREA(II,J1)=UNITAR
   IF (AREA(II,J1).EQ.UNITAR) GO TO 50
   IINC=-IINC
   II=II
   II=II+IINC
70 IF (II.LT.IGU.OR.II.GT.IKWIT) RETURN
   IF (AREA(II,J1).EQ.UNITAR) AREA(II,J1)=0.
   IF (AREA(II,J1).EQ.0.) GO TO 70
   RETURN
C
C ENTRY FINAL (DIMENY,DIMENX,UNITAR,IGU,IKWIT,JGU,JKWIT)
C
C 'FINAL' IS CALLED BY 'TRACKER' AFTER THE TRACK OF A COUNTY BOUNDARY
C THROUGH THE GRID CELL ARRAY IS COMPLETED. 'FINAL' MAKES THE FINAL
C DETERMINATION OF CELLS EXTERIOR TO THE BOUNDARY CELLS.
C THE PRINCIPLE IS THAT ALL CELLS ON A GIVEN ROW (OR COLUMN) BETWEEN
C THE ENCLOSING RECTANGLE AND THE FIRST OCCURRENCE OF A BOUNDARY CELL
C ON THAT ROW (OR COLUMN) ARE EXTERIOR TO THE BOUNDARY.
C
C FIRST FINISH DETERMINATION OF INTERIOR CELLS.
C
   IG1=IGU+1
   JG1=JGU+1
   IKW=IKWIT-1
   JKW=JKWIT-1
   DO 80 I=IG1,IKW
   DO 80 J=JG1,JKW
   IF (AREA(I,J).NE.0.) GO TO 80
   IF (AREA(I,J-1).EQ.UNITAR) AREA(I,J)=UNITAR
   IF (AREA(I-1,J).EQ.UNITAR) AREA(I,J)=UNITAR
   IF (AREA(I,J+1).EQ.UNITAR) AREA(I,J)=UNITAR
   IF (AREA(I+1,J).EQ.UNITAR) AREA(I,J)=UNITAR
   CONTINUE
80 DO 120 I=IGU,IKWIT
   DO 90 J=JGU,JKWIT
   IF (AREA(I,J).GT.UNITAR.AND.AREA(I,J).LT.0.) GO TO 100
   AREA(I,J)=0.
90

```

```

100 J=JKWIT
    DO 110 JJ=JGU,JKWIT
    IF (AREA(I,J).GT.UNITAK.AND.AREA(I,J).LT.0.) GO TO 120
    AREA(I,J)=0.
110 J=J-1
120 CONTINUE
C
C WORK FROM VERTICAL SIDES JGU AND JKWIT.
    DO 130 JJ=JGU,JKWIT
    DO 130 II=IGU,IKWIT
    IF (AREA(I,J).GT.UNITAK.AND.AREA(I,J).LT.0.) GO TO 140
130 AREA(I,J)=0.
140 I=IKWIT
    DO 150 II=IGU,IKWIT
    IF (AREA(I,J).GT.UNITAK.AND.AREA(I,J).LT.0.) GO TO 160
    AREA(I,J)=0.
150 I=I-1
160 CONTINUE
C
C CONVERT NEGATIVE AREA VALUE TO POSITIVE AND RESET BOUNDARY
    CELLS WITH AREA .999 (TRICK VALUE) TO 1.0
    DO 170 J=JGU,JKWIT
    DO 170 J=JGU,JKWIT
    IF (AREA(I,J).EQ..999) AREA(I,J)=UNITAK
    IF (AREA(I,J).LT.0) AREA(I,J)=-AREA(I,J)
170 RETURN
C
END

```

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00010100
00010200

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C          COMPILER (XN=3)                                00000100
C          SUBROUTINE PROXPR (DIMENY,DIMENX,IGO,IKWIT,JGO,JKWIT,A,H,C) 00000200
C          TO PRINT SYMBOLS FOR NUMERICAL VALUES TO SHOW COUNTY OUTLINES AND 00000300
C          INTERIORS.                                00000400
C          LOGICAL LINE(100),BLANK/' ',ASTER/'****'/,ONE/'IIII'/' 00000500
C          INTEGER DIMENY,DIMENX                                00000600
C          COMMON /SPEC/ F(175,205),X(160),Y(4,3150)            00000700
C          COMMON /OUTFILE/ NR,NP,HPUNCH,NINI,NIN2,NOUT1,NOUT2    00000800
C          JG=JG+100                                           00000900
C          JK=JG+100                                           00001000
C          IF (JK.GT.IKWIT) JK=JKWIT                            00001100
C          L=1                                                  00001200
C          WRITE (NP,20) ((L,M=1,10),L=1,9)                    00001300
C          FORMAT (13X10011)                                    00001400
C          WRITE (NP,30) ((L,L=1,10),M=1,10)                    00001500
C          FORMAT (4X10011)                                      00001600
C          L=IKWIT                                              00001700
C          DO 60 I1=100,IKWIT                                    00001800
C          L=0                                                  00001900
C          DO 40 J=JG,JK                                        00002000
C          L=L+1                                                00002100
C          LINE(L)=ASTER                                         00002200
C          IF (F(I,J).EQ.A) LINE(L)=BLANK                       00002300
C          IF (F(I,J).GE.C) LINE(L)=ONE                         00002400
C          USAGE (EXAMPLE) A B C = EXTERIOR BOUNDARY INTERIOR = BLANK * I 00002500
C          C=0                                                  00002600
C          WRITE (NP,50) I,(LINE(L),L=1,M)                     00002700
C          FORMAT (14,100A1)                                     00002800
C          L=L-1                                                00002900
C          JG=JG+1                                              00003000
C          IF (JG.LE.IKWIT) GO TO 10                            00003100
C          RETURN                                              00003200
C          00003300
C          00003400
C          00003500
C          00003600
C          00003700

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00003800
00003900

C END


```

C
C INITIALIZE FOR THIS 1 COUNTY.
C
10
20
30
40
C
C*****SET COUNTY RECORD INDICATOR.
C
C*****READ CAASE1 TAPE. WHEN AN EOF IS REACHED, MUST CHECK TO SEE IF ANY
C MORE COUNTY FILES ARE ON THIS AQCR TAPE.
C
50
C
C TOTALS FOR ALL COUNTIES
KREL=KREL+1
SUMPUP=SUMPUP+TPOP
SOMOUS=SOMOUS+THOUS
60
C
C 1617 FORMAT(2I10,4F20.5)
JS1AT=KSTAT
JCN1Y=KCN1Y
XTHOUS=THOUS
XPOP=TPUP
XOUT=TXOUT
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00010000
00010100
00010200
00010300
00010400
00010500
00010600
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00010800
00010900
00011000
00011100

YOUT=YOUT
NREC=NREC+1
TOTPOP=TOTPOP+XPOP
TOTHOS=TOTHOS+XHOUS
X=XOUT-XORIG
Y=YOUT-YORIG
I=Y
J=X
IF (I.LT.IG0) GO TO 50
IF (I.GT.IKWT) GO TO 50
IF (J.LT.JG0) GO TO 50
IF (J.GT.JKWT) GO TO 50
IPOP=XPOP
IHOUS=XHOUS
PRINT 1616,NREC,I,J,IPOP,IHOUS
C STORE THE POPULATION AND HOUSING VALUES FOR THIS CENSUS E.D. IN THE
C CENSUS CELL (J,I), J AND I CORRESPONDING TO TRUNCATED COORDINATES
C X AND Y OF THE CENSUS E.D.
F(J,I)=(IPOP*ISHIFT+IHOUS)+F(J,I)
GO TO 50
C *****HAVE REACHED END OF COUNTY # 'ICOUNT' OR AN EOF ON THE INPUT TAPE.
C
70 IF ILE=IFILE+1
C *****THE COUNTY HAS BEEN COMPLETED.
C
WRITE (IPRINT,40) AUCK,NREC,NL
C
C PLACE POPULATION DATA IN VECTOR STORAGE RANK-ORDERED (SORTED) ON
C X-COORDINATE (PRIMARY), Y-COORDINATE (SECONDARY) BOTH INCREASING.
C CRITICAL FOR SUBSEQUENT DIRECT SEARCH USED TO CONSTRUCT PROXIMAL MAP
L=0
DO 60 I=IG0,IKWT
DO 60 J=JG0,JKWT
IF (F(J,I).LE.0) GO TO 60

```

```

L=L+1
POP(L)=F(J,I)/ISHIFT
IPUP=POP(L)+0.5
HOUS(L)=F(J,I)-IPUP*ISHIFT
C
C THIS STEP DETERMINES TOTAL POPULATION AND HOUSING ASSOCIATED WITH THE
C L-TH. CENSUS CELL. THE AREA ASSOCIATED WITH THE L-TH. CELL WILL BE
C DETERMINED FROM THE PROXIMAL MAP.
C
IY(L)=I
JX(L)=J
C PRINT 1010,L,I,J,POP(L),HOUS(L)
C 1010 FORMAT(3I5,2E12.5)
80 CONTINUE
NCONT=L
RETURN
C
END
00011200
00011300
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00012900

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C
LUMPIER (XM=3)
SUBROUTINE PRUXML (DIMENY, DIMENX, IGO, IKWIT, JGO, JKWIT, LGO, NMCNTL)
INTEGER DIMENY, DIMENX
DIMENSION LGO(DIMENY)
COMMON /SPEC/ F(175,205), ANCH(5), STATE(5,10), CNTY(5,15), IDCO(15), N00000600
1 RECU(15), ICNTL(2520), JCNTL(2520), POP(2520), HOUS(2520), AREA(2520)
COMMON /LINFO/ NSTATE, NUMCO, NRECT, NX, NY, LIWU, GXNIN, GXMAX, GYMIN, GYM000000800
1 AX, XURIG, YURIG, MTUZ, ID, YASSUC
COMMON /IOFILE/ NR, NP, NPUNCH, NIN1, NIN2, NOUT1, NOUT2
COMMON /IPARM/ UNITAR, ISHIFT, XMAXD, YMAXD, EPS, MAXSQR
C
PRINT 1401, NMCNTL
C IDENTIFY AND FLAG CONTROL CELLS IN THE GRID CELL ARRAY F(1,J).
L=0
DO 30 LL=1, NMCNTL
1=ICNTL(LL)
J=JCNTL(LL)
C
C IS THE LL-TH. CONTROL CELL INSIDE THE COUNTY BOUNDARY?
IF (F(1,J).NE.0.) GO TO 20
C CONTROL CELL # LL IS OUTSIDE THE COUNTY. REMOVE IT FROM THE LIST.
WRITE (NP,10) LL, I, J, POP(LL), HOUS(LL)
FORCAT (' SUBROUTINE PRUXML. CELL # ', I4, ', I, J COORDINATES ', 200002500
114, ' IS OUTSIDE THE BOUNDARY OF THIS COUNTY. ', ' ITS POPULATION AN000002600
20 HOUSING COUNTS ARE: ', 2F10.0)
GO TO 30
L=L+1
JCNTL(L)=ICNTL(LL)
JCNTL(L)=JCNTL(LL)
AREA(L)=F(1,J)
POP(L)=POP(LL)
HOUS(L)=HOUS(LL)
F(1,J)=L
CUMULHOL
HMCNTL=L
C
30

```

```

40      UU 40 J=JGU,JKWIT
      UU 40 I=IGU,IKWIT
      IF (F(I,J).NE.0.) F(I,J)=-F(I,J)
      AREA(NMCNTL+1)=0
      C
      C
      CALL SETLGO (IGU,IKWIT,NMCNTL,LGO)
      C
      C      FIND THE CONTROL CELL NEAREST EACH NON-CONTROL CELL (I,J).
      C      STORE THE INDEX OF THE NEAREST CONTROL CELL IN F(I,J).
      C
      C      CALL SEARCH (DIMENY,DIMENX,IGU,IKWIT,JGU,JKWIT,LGO,NMCNTL)
      C
      C      COMPUTE DENSITY FOR EACH CONTROL CELL BASED ON TOTAL AREA OF NEAREST
      C      NEIGHBORS ASSOCIATED WITH IT.
      C
      UU 50 L=1,NMCNTL
      PRINT 1615, L, AREA(L), POP(L), HOUS(L)
      IF (AREA(L).EQ.0.) GO TO 50
      POP(L)=POP(L)/AREA(L)
      HOUS(L)=HOUS(L)/AREA(L)
      PRINT 1616, POP(L), HOUS(L)
      C
      C      CONTINUE
      C
      C      RETURN
      C
      END

```

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00006400

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```

C      PRINT 200,I,LSAVI
C      RS=(I-IY(LSAV1))*2+(JGU-JX(LSAV1))*2
C      PRINT 199,IY(LSAV1),JX(LSAV1),RS
C      DO 50 J=JGU,JKWIT
C
C      (I,J) MAY BE OUTSIDE BOUNDARIES: F(I,J)=0
C      MAY BE A CONTROL CELL: F(I,J) GT 0 (INDEX OF THE CONTROL CELL)
C      MAY BE UNASSIGNED: F(I,J) LT 0.
C
C      PRINT 201,I,J,F(I,J)
C      IF (F(I,J).GE.0.) GO TO 50
C      RS=SQRT(RS)
C
C      INDICES OF THE RECTANGLE CONTAINING THE MAXIMUM SEARCH RADIUS, RS.
C
C      JRMIX=J+RS+1
C      JRMIN=J-(RS+1)
C      IRMAX=I+RS+1
C      IRMIN=I-RS-1
C      IF (IRMIN.LT.IGU) IRMIN=IGU
C      IF (JRMIN.LT.JGU) JRMIN=JGU
C      IF (IRMAX.GT.IKWIT) IRMAX=IKWIT
C      IF (JRMIX.GT.JKWIT) JRMIX=JKWIT
C      LLGU=LGU(IRMIN)
C      RSUM=MAX
C      PRINT 202,IRMAX,IRMIN,JRMIX,JRMIN,LLGU
C      DO 50 L=LLGU,NMINTL
C      PRINT 203,L,IY(L),JX(L)
C      IF (IY(L).GT.IRMAX) GO TO 40
C      IF (JX(L).GT.JRMIX) GO TO 50
C      IF (JX(L).LT.JRMIN) GO TO 30
C
C      CONTROL CELL L IS IN I+IRMAX,I-IRMIN,J+JRMIX,J-JRMIN
C
C      IDLL=I-IY(L)
C      JDLL=J-JX(L)
C      NODIAG=IDEL*IDEL+JDLL*JDLL

```

```

C      PRINT 204, IDEL, JDEL, RSQUAR, RSQMIN
C      IF (RSQUAR-RSQMIN) 20,10,30
10     CALL TIEBRK (RSQUAR,RSQMIN,&20,&30)
20     RSQMIN=RSQUAR
C      LSAVEL
C      IF (J.EQ.JG0) LSAV1=LSAV
C      PRINT 205, RSQMIN, LSAV, LSAV1, F(I,J)
30     CONTINUE
C      F(I,J) CONTAINS NEGATIVE VALUE OF AREA OF CELL (I,J).
C      THE ALGEBRAIC SIGN OF F(I,J) IS NEGATIVE. -F IS +.
C
C      PRINT 206, I,J,LSAV,F(I,J)
40     CONTINUE
C      AREA(LSAV)=AREA(LSAV)-F(I,J)
C      F(I,J)=LSAV
C
C      COMPUTE THE DISTANCE FROM THE CONTROL CELL FOUND NEAREST (I,J) TO
C      THE NEAT CELL ADJACENT, (I,J+1). THERE IS NO NEED TO SEARCH OVER
C      CONTROL CELLS GREATER THAN THIS DISTANCE AWAY FROM (I,J+1).
C
C      RS=RSQMIN+.2*(J-JX(LSAV))+1.
50     CONTINUE
60     CONTINUE
C      RETURN
C
C      ENTRY SETLGO (IG0,IKWIT,NMCNLT,LG0)
C      SETLGO COMPUTES VALUES FOR ARRAY LG0(I), I=IG0 . . . IKWIT.
C      SETLGO DETERMINES WHICH CONTROL CELL IS THE FIRST TO OCCUR ON A LINE
C      OF Y=CONSTANT. THE INDEX OF THAT CONTROL CELL, L, IS STORED IN
C      ARRAY LG0(I) WHERE I = INTEGER OF Y=CONSTANT.
C      FOR ALL VALUES OF I GREATER THAN Y UP TO THE NEXT LINE Y CONTAINING
C      A CONTROL CELL, LG0 IS SET EQUAL TO L.
C      THE VALUES OF ARRAY LG0 ARE USED IN SUBROUTINE 'SEARCH'.
C      LG=IG0
C      IYLAST=0
C      DO 80 L=1,NMCNLT

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00010100
00010200
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00011000
00011100

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```

C      PRINT111,L,IY(L),IYLAST,IK
      IF (IY(L).EQ.IYLAST) GO TO 80
      IYLAST=IY(L)
      IK=IYLAST
      DO 70 I=IG,IK
        PRINT112,I,I, L
        LGO(I)=L
        IG=IK+1
      CONTINUE
      DO 90 I=IK,IYLAST
        LGO(I)=IYLAST
      RETURN
C      END

```

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```

SUBROUTINE TIEBRK (A,B,*,*)
IMPLICIT INTEGER (A-Z)
REAL ZZ
DATA NNN /123321/
CALL RANDU (NNN,NNN,ZZ)
IF (ZZ.GT.0.5) RETURN 3
RETURN 4

```

C

```

SUBROUTINE RANDU (IX,IY,YFL)
IY=IX*65539
IF (IY) 10,20,20
IY=IY+2147433647+1
YFL=IY
YFL=YFL*.4656613E-9
RETURN

```

10
20

C

END

```

00000100
00000200
00000300
00000400
00000500
00000600
00000700
00000800
00000100
00000200
00000300
00000400
00000500
00000600
00000700
00000800
00000900

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```

      SWX(M)=0
      SWY(M)=0
      POPULA(M)=0
      NUMSUR(M)=0
      SL(M)=0
40  C
C    C    ATTEMPT TO READ A USER-PROVIDED SET OF GRID SQUARE CARDS
C    C    REPRESENTING A PREVIOUSLY DERIVED GRID. IF THE SET IS EMPTY, RETURN
C    C    TO THE MAIN CALLING PROGRAM IS TO NORMAL GRIDGING PROCEDURE.
C    C    IF THERE ARE GRID SQUARE CARDS, THE USER-SPECIFIED GRID WILL BE USED
C
      M=0
50  READ (NR,500,END=60) MM,IFRAC,ISTATE,ICOUNT,MTUZ,XX,YY,ISL
      M=M+1
      SL(M)=ISL
      SWY(M)=YY-YORIG
      SWX(M)=XX-XORIG
      GO TO 50
60  IF (M.EQ.0) GO TO 70
      NUMSUR=M
      RETURN 2
70  DO 80 I=1,NY
      IV=(I-1)*LWID
      DO 80 J=1,NX
      JAV=(J-1)*LWID
      M=M+1
      SWX(M)=JX
      SWY(M)=IY
      SL(M)=LWID
      NUMSUR=M
C    WRITE(NP,52) NUMSUR,(I,SWX(M),SWY(M),SL(M),M=1,NUMSUR)
      M=0
90  M=M+1
C    PRINT 54, M
      IF (M.GT.NUMSUR) GO TO 110
      IF (M.GT.MAXSUR) RETURN 1
C

```

```

C INTEGRATE F(Y,X) OVER SQUARE NUMBER M:
100 CALL INTRG (M,DIMENY,DIMENX,XINT)
C
C IF (XINT.EQ.0.) CALL DELETE (&100,M,NUMSQ)
C
C PRINT 35,M,XINT,POPULA(M),SQX(M),SQY(M),SL(M)
C IF SQUARE #M CONTAINS MORE THAN FMAX POPULATION, PARTITION IT;
C IF NOT, GO TO NEXT SQUARE, M+1.
C
C IF (XINT.LE.FMAX) POPULA(M)=XINT
C IF (XINT.LE.FMAX) GO TO 90
C
C STOP PARTITIONING CELL #M WHEN IT BECOMES SIZE UNITAR.
C
C IF (SL(M).EQ.UNIT) GO TO 90
C CALL PARTIT (&110,&100,M,NUMSQ)
C
C ADJUST CONTAINED POPULATION .
C
110 IF (NUMSQ.GT.MAXSQ) RETURN 1
WRITE (JP,120) M,NUMSQ
120 FORMAT (/ ' 210. M GREATER THAN NUMSQ.',215)
SUMF=0
DO 130 M=1,NUMSQ
PRINT 36,M,POPULA(M),SUMF
SUMF=SUMF+POPULA(M)
A=SUMF
B=TUTPOP
LL=B/A
PRINT 39, A,B,CC
SUMF=0
DO 140 M=1,NUMSQ
POPULA(M)=POPULA(M)*CC
SUMF=SUMF+POPULA(M)
ERRPOP=TUTPOP-SUMF
RETURN
C

```

```

      EMPTY ADJUST (*,NUMSQ)
      AREA (NP,150) NUMSQ
150  FORMAT (/,' SUBR. ADJUST.  NUMBER OF SQUARES =',15)
C    ADJUST DELETES EMPTY SQUARES AND PARTITIONS SQUARES TRANSECTED BY
C    THE BOUNDARY.  SUCH SQUARES CONTAIN AT LEAST ONE EMPTY (ZERO
C
      I4=4.*UNITAR
      M=0
      M=M+1
160  IF (M.GT.NUMSQ) RETURN
170  IF (POPULA(M).LE.0.) CALL DELETE (&170,M,NUMSQ)
C    DO NOT PARTITION SQUARES LESS THAN OR EQUAL TO I4 IN SIZE.
      IF (SL(M).LE.I4) GO TO 160
      ISL=SL(M)
C
C    PARTITION SQUARES THAT ARE TOO LARGE:
      IF (ISL.GE.32) CALL PARTIT (&210,&190,M,NUMSQ)
      AREA=ISL*ISL
      IG=SQRT(M)+1
      IA=IG+ISL-1
      JG=SQRT(M)+1
      JA=JG+ISL-1
      IAREA=0.
C
C    COMPUTE NUMBER UNIT AREA CELLS INSIDE SQUARE AND INSIDE COUNTY
C    BOUNDARY.
      DO 180 I=IG,IA
      DO 180 J=JG,JA
180  IF (F(I,J).NE.0.) IAREA=IAREA+UNITAR
      IF (ABS(IAREA)/AREA=0.50) GO TO 160
C
C    PARTITION SQUARE WHICH HAS LESS THAN 50% AREA INTERIOR TO COUNTY.
C
      CALL PARTIT (&210,&190,M,NUMSQ)
C
C    UPDATE NEW CELLS RESULTING FROM PARTITIONING DUE TO TRANSECT:
190  CALL TRIGR (M,DIMENY,DIMENX,XINI)
00011200
00011300
00011400
00011500
00011600
00011700
00011800
00011900
00012000
00012100
00012200
00012300
00012400
00012500
00012600
00012700
00012800
00012900
00013000
00013100
00013200
00013300
00013400
00013500
00013600
00013700
00013800
00013900
00014000
00014100
00014200
00014300
00014400
00014500
00014600
00014700
00014800

```



```

IF (KK.NE.2) READ (NOUT) LL,ID,IGO,IKWIT,JGU,JKWIT
DO 240 I=IGO,IKWIT
  READ (NOUT) (F(1,J),J=JGU,JKWIT)
  IF (KK.NE.3) GO TO 260
DO 250 IK=2,3
DO 250 II=IGO,IKWIT
  READ (NOUT) DUMM
C
C  PROCESS THE GRID SQUARES, M=1,2,....,NUMSUR.
260  IF (KK.EQ.1) KSUR=NUMSUR
    IF (KK.GT.1) KSUR=NRSOK
    DO 290 MPRIME=1,KSUR
      M=MPRIME
C
C  DOES SQUARE M SHARE ANY COMMON AREA WITH RECTANGLE THAT CONTAINS THIS
C  COUNTY?
C
    IF (SUX(M).GT.IKWIT) GO TO 290
    IF (SUX(M).GT.JKWIT) GO TO 290
    IF (SUX(M)+SL(M).LT.IGO) GO TO 290
    IF (SUX(M)+SL(M).LT.JGU) GO TO 290
C  DOES SQUARE M SHARE ANY COMMON AREA WITH THIS COUNTY?
    CALL INTR (M,DIMENY,DIMENX,XINT)
    IF (XINT.LE.0.) GO TO 290
C
C  THE INTEGRAL GREATER THAN ZERO MEANS SOME OF THIS COUNTY IS IN SQUARE
C  NUMBER M.
C  IS THIS THE FIRST COUNTY TO HAVE CONTENTS IN SQUARE M?
C
    IF (KK.EQ.1.AND.POPULA(M).EQ.0.) GO TO 270
    IF (KK.EQ.2.AND.HOUSIN(M).GT.0.) GO TO 290
    IF (KK.EQ.3.AND.FRAC(M).GT.0.) GO TO 290
    IF (KK.GT.1) GO TO 280
C
C  NON-ZERO VALUE OF POPULA OR HOUSIN OR FRAC FOR SQUARE M MEANS THAT
C  SQUARE M HAS OCCURRED FOR A PRIOR COUNTY. THIS IS A NEW COUNTY FOR
00018600
00018700
00018800
00018900
00019000
00019100
00019200
00019300
00019400
00019500
00019600
00019700
00019800
00019900
00020000
00020100
00020200
00020300
00020400
00020500
00020600
00020700
00020800
00020900
00021000
00021100
00021200
00021300
00021400
00021500
00021600
00021700
00021800
00021900
00022000
00022100
00022200

```



```

IF (KK.EQ.2) INP=NPUNCH
MM=0
DO 320 M=1,NUMSUR
IF (POPULA(M).EQ.0.) GO TO 320
MM=MM+1
L=COUNTY(M)/1TW018
ISTATE=IDCU(L)/1000
ICOUNT=IDCU(L)-ISTATE*1000
IFRAC=FRAC(M)*1.E5
YY=SWY(M)+YURIG
XX=SWX(M)+XURIG
WRITE (INP,510) MM,IFRAC,ISTATE,ICOUNT,MTUZ,XX,YY,SL(M),HOUSIN(M),
POPULA(M)
CONTINUE
RETURN
320
C
END
00026000
00026100
00026200
00026300
00026400
00026500
00026600
00026700
00026800
00026900
00027000
00027100
00027200
00027300
00027400
00027500
00027600

```



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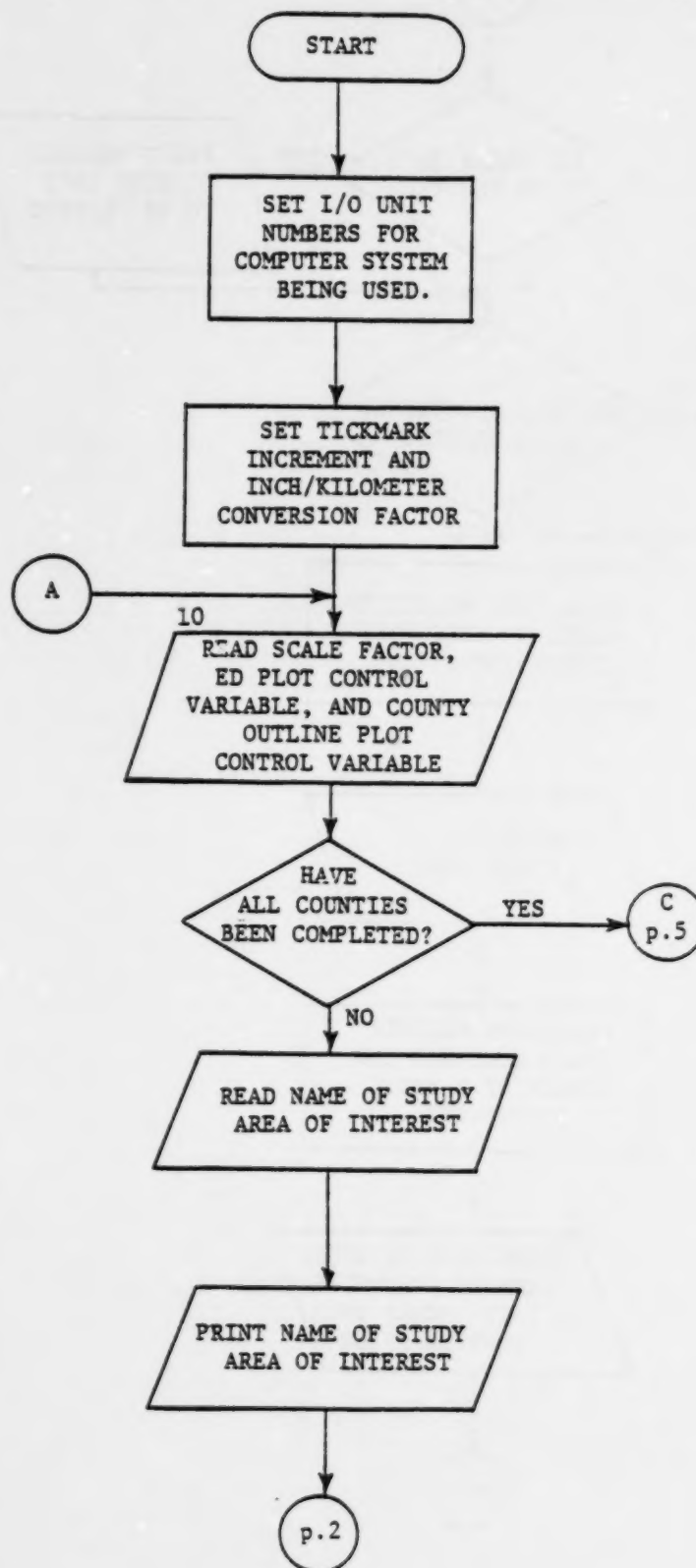
20      POPULA(L)=POPULA(LP1)
C      RETURN 1
C      ENTRY PARTIT (*,*,M,NUMSUR)
C      THE FIRST RETURN * IS ERROR RETURN IN CASE NUMBER OF SQUARES EXCEEDS
C      THE MAXIMUM BECAUSE OF PARTITIONING.
C      THE SECOND RETURN * IS NORMAL RETURN TO CALLING PROGRAM.
      ISLM=SL(M)/2
      SLM=ISLM
      IF (SLM.LT.UNIAR) RETURN 2
      L=NUMSUR
      LP1=L+1
      LP2=L+2
      LP3=L+3
      IF (LP3.GT.MAXSUR) RETURN 1
      SL(M)=ISLM
      SL(LP1)=ISLM
      SL(LP2)=ISLM
      SL(LP3)=ISLM
      SUX(LP1)=SUX(M)+ISLM
      SUX(LP1)=SUX(M)
      SUX(LP2)=SUX(LP1)
      SUX(LP2)=SUX(M)+ISLM
      SUX(LP3)=SUX(LP2)
      SUX(LP3)=SUX(M)
      NUMSUR=NUMSUR+3
      RETURN 2
C      END

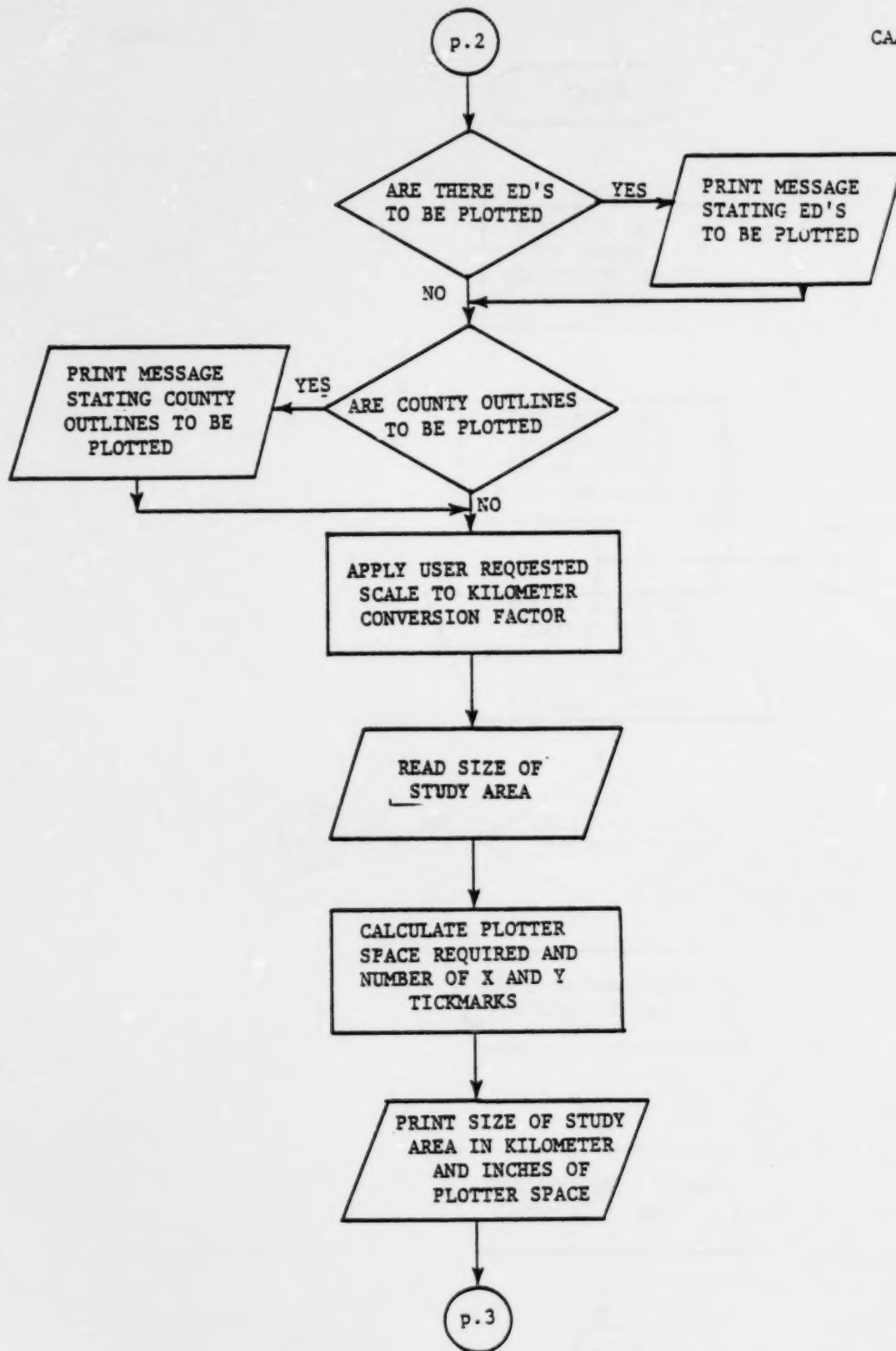
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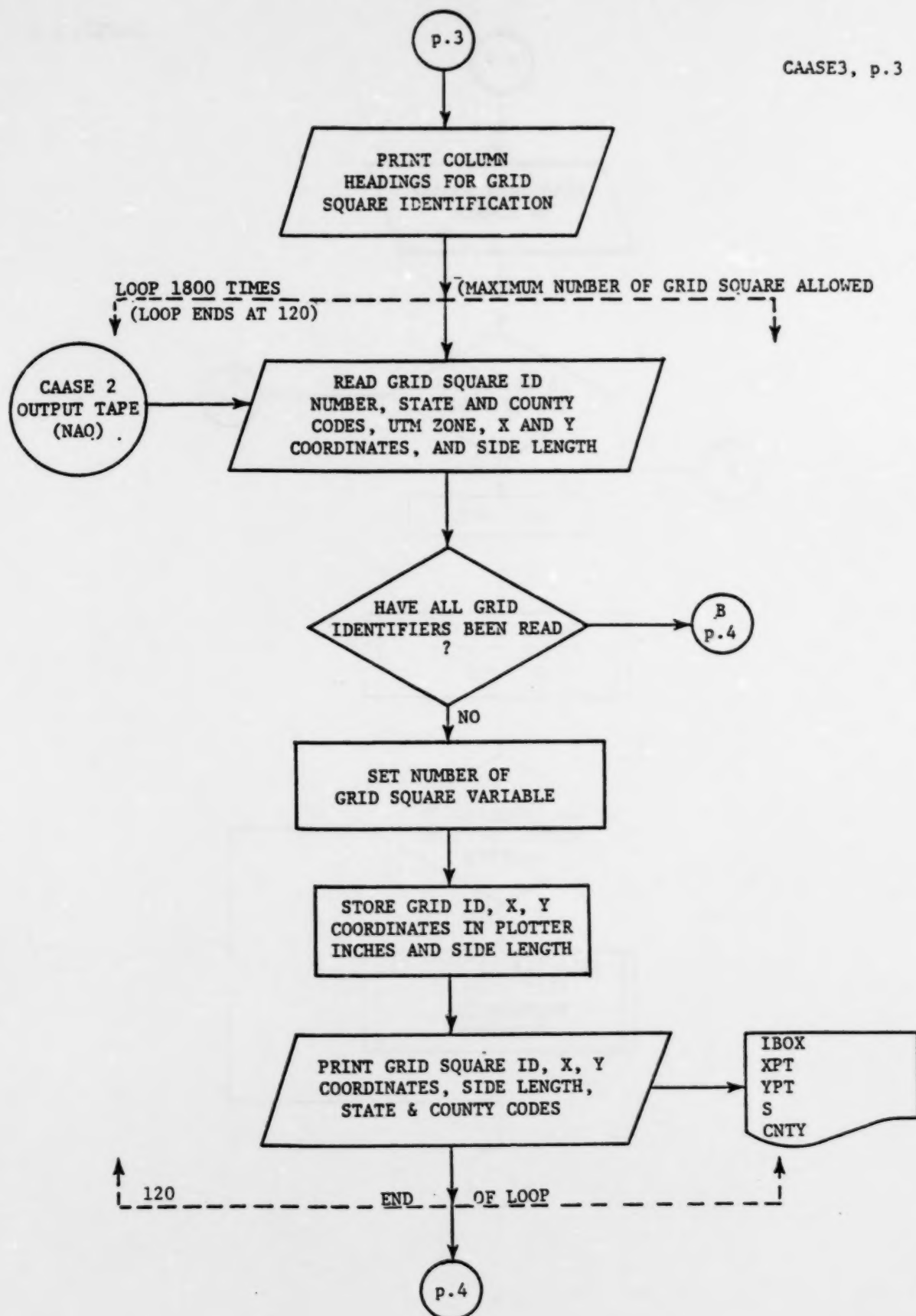

APPENDIX C

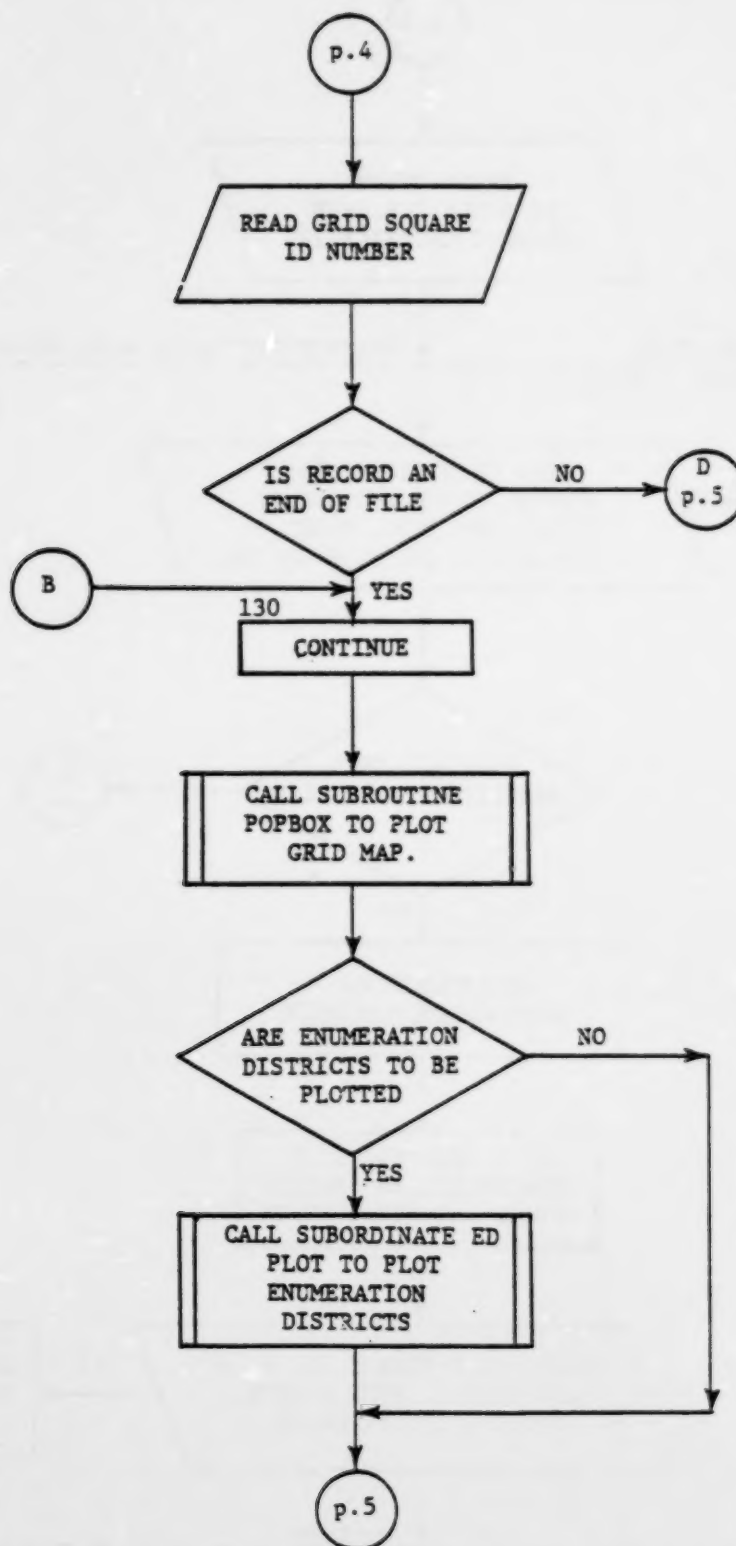
LOGICAL FLOWCHARTS AND FORTRAN SOURCE CODE LISTINGS

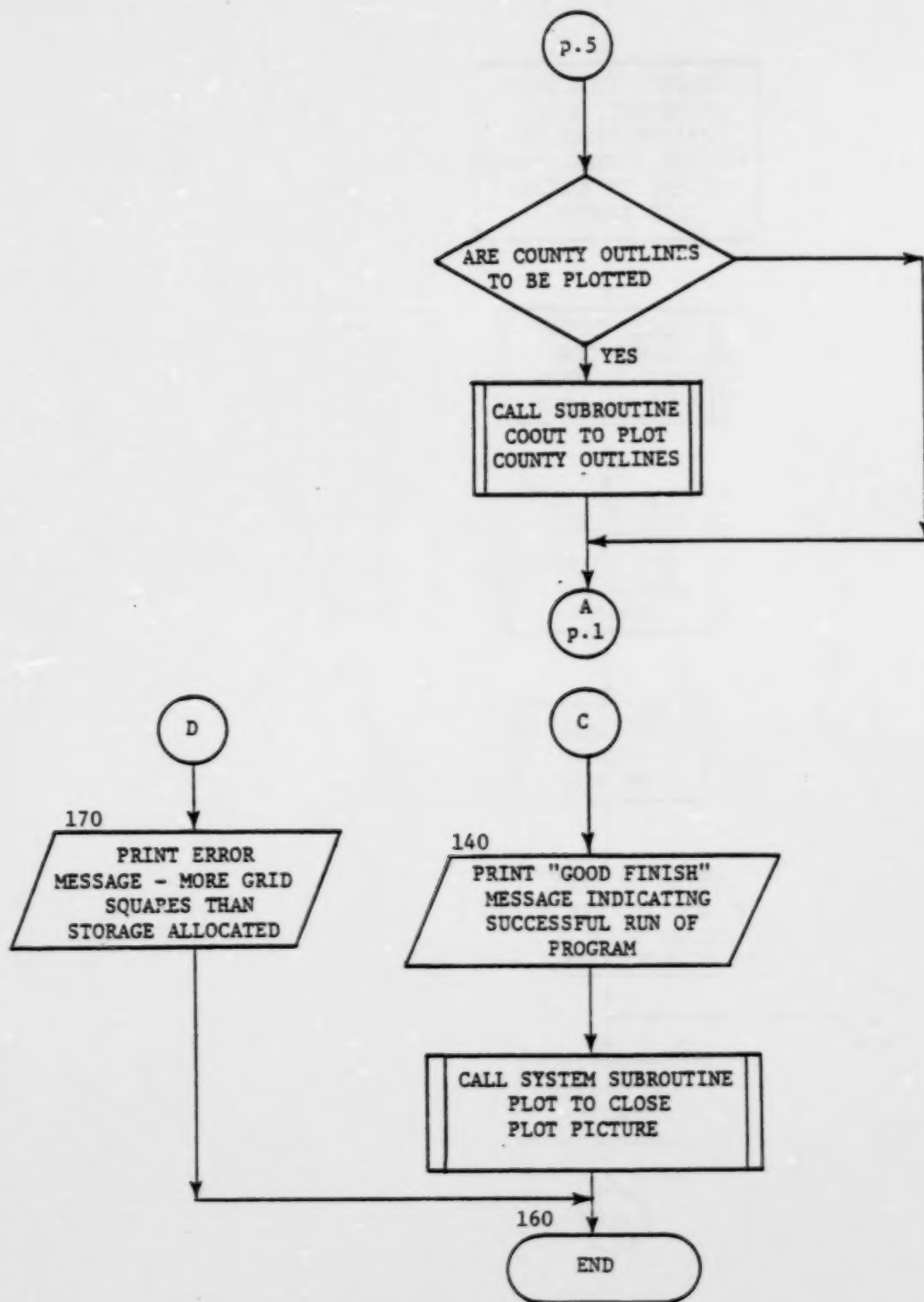
CAASE3 (and Subroutines)

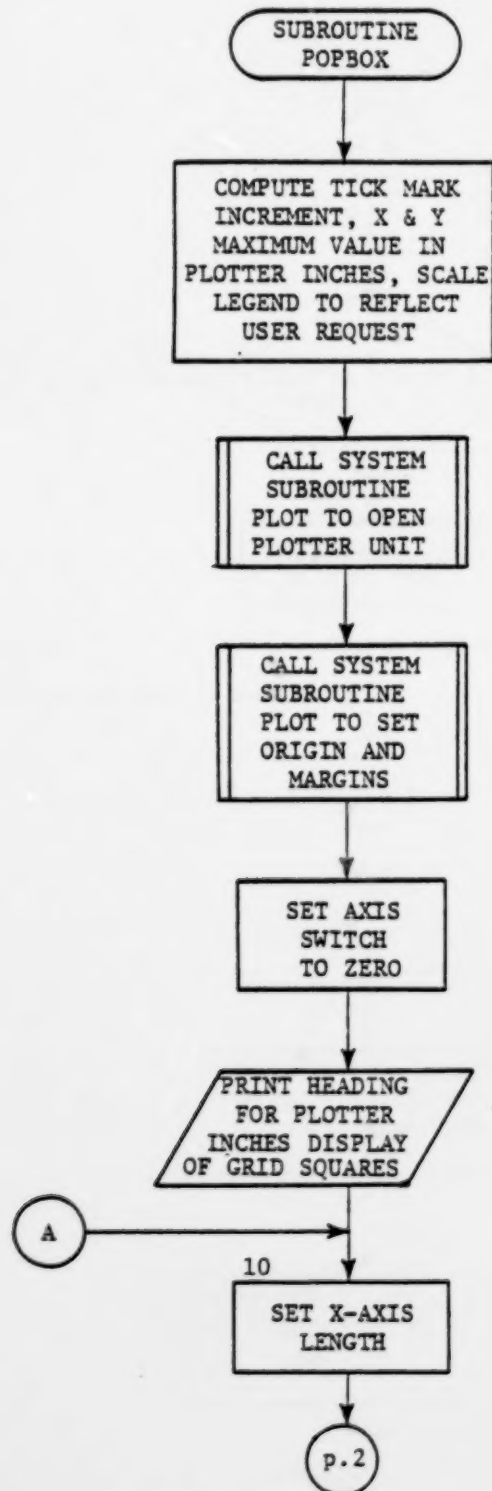


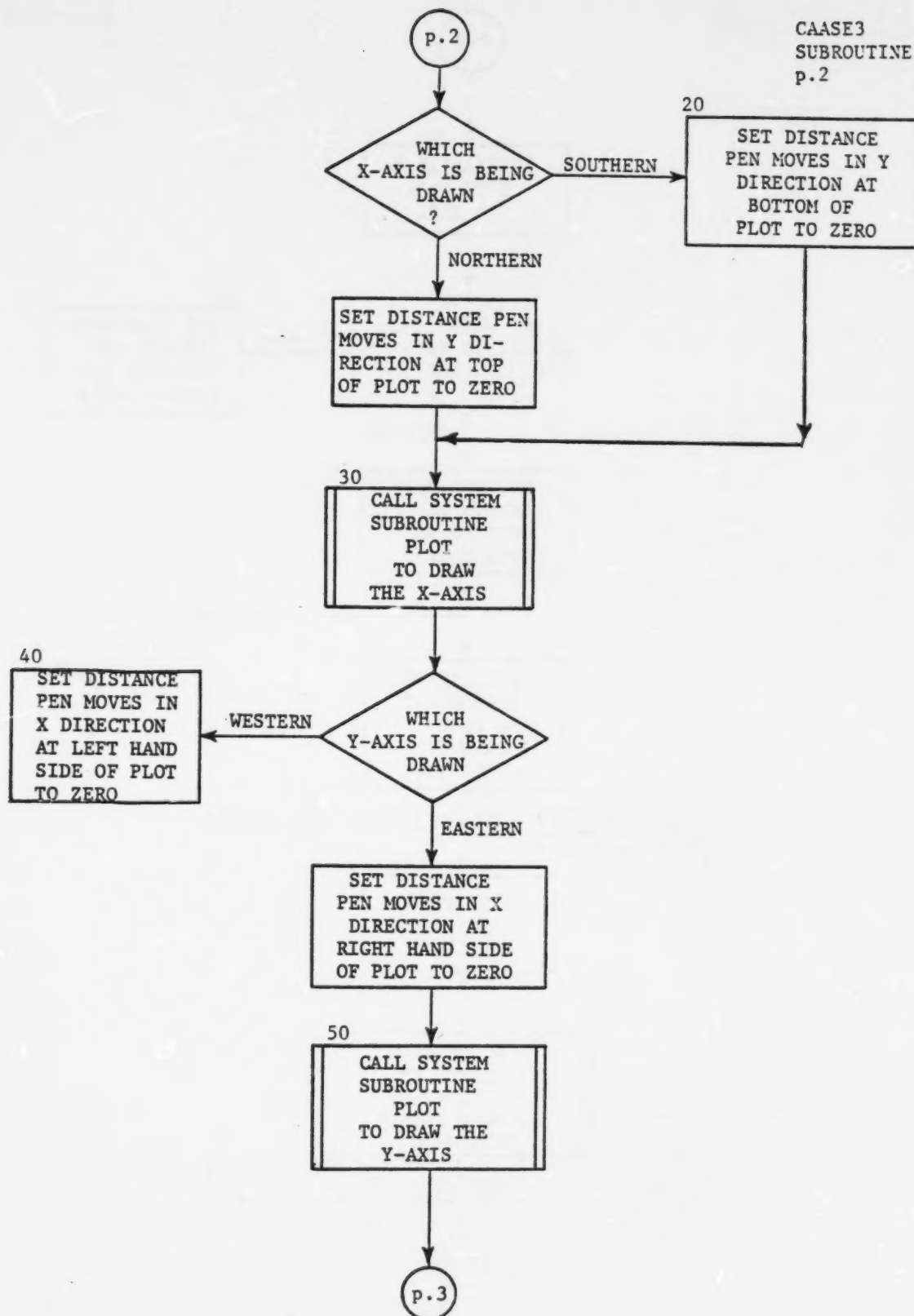


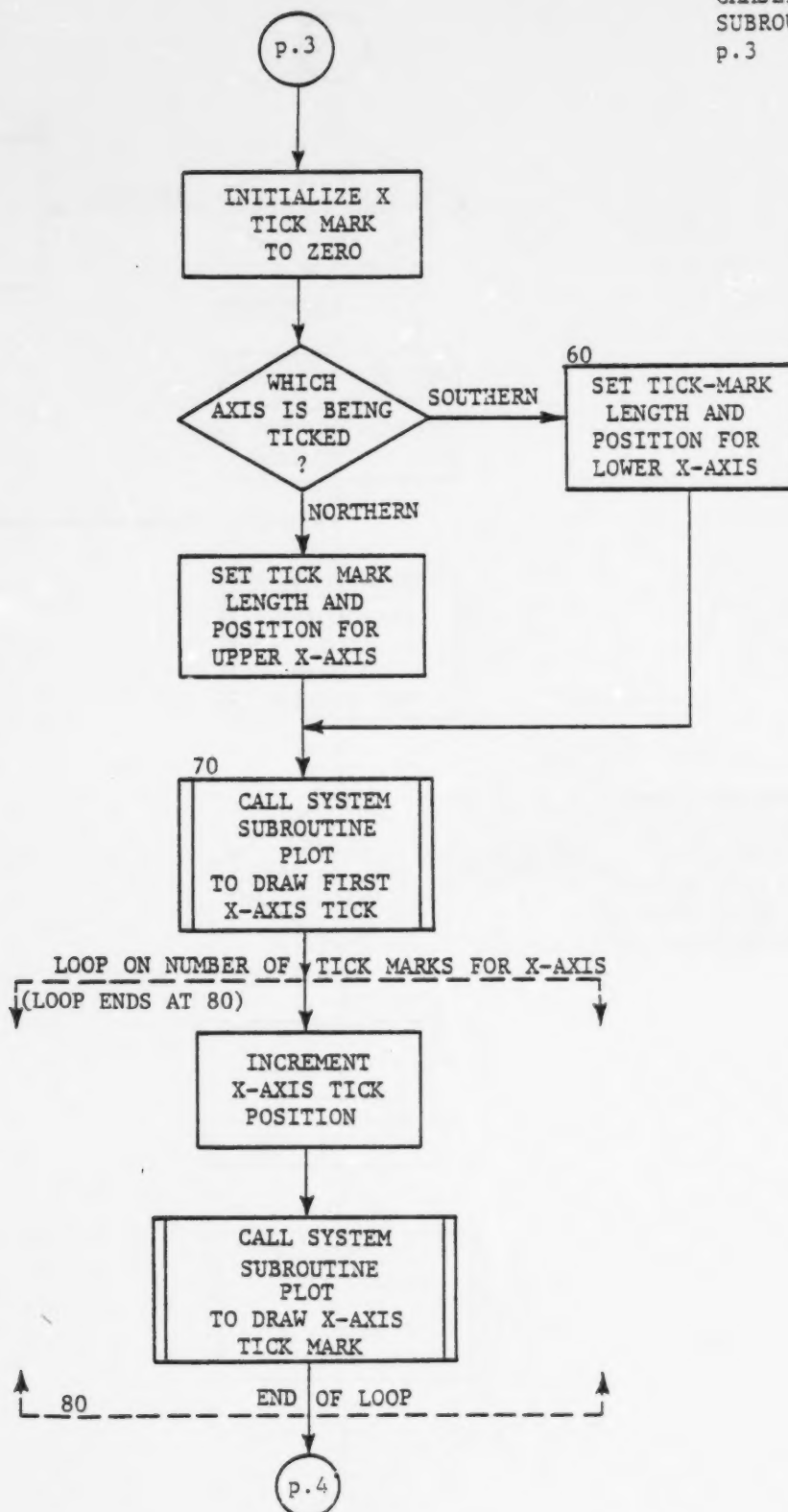


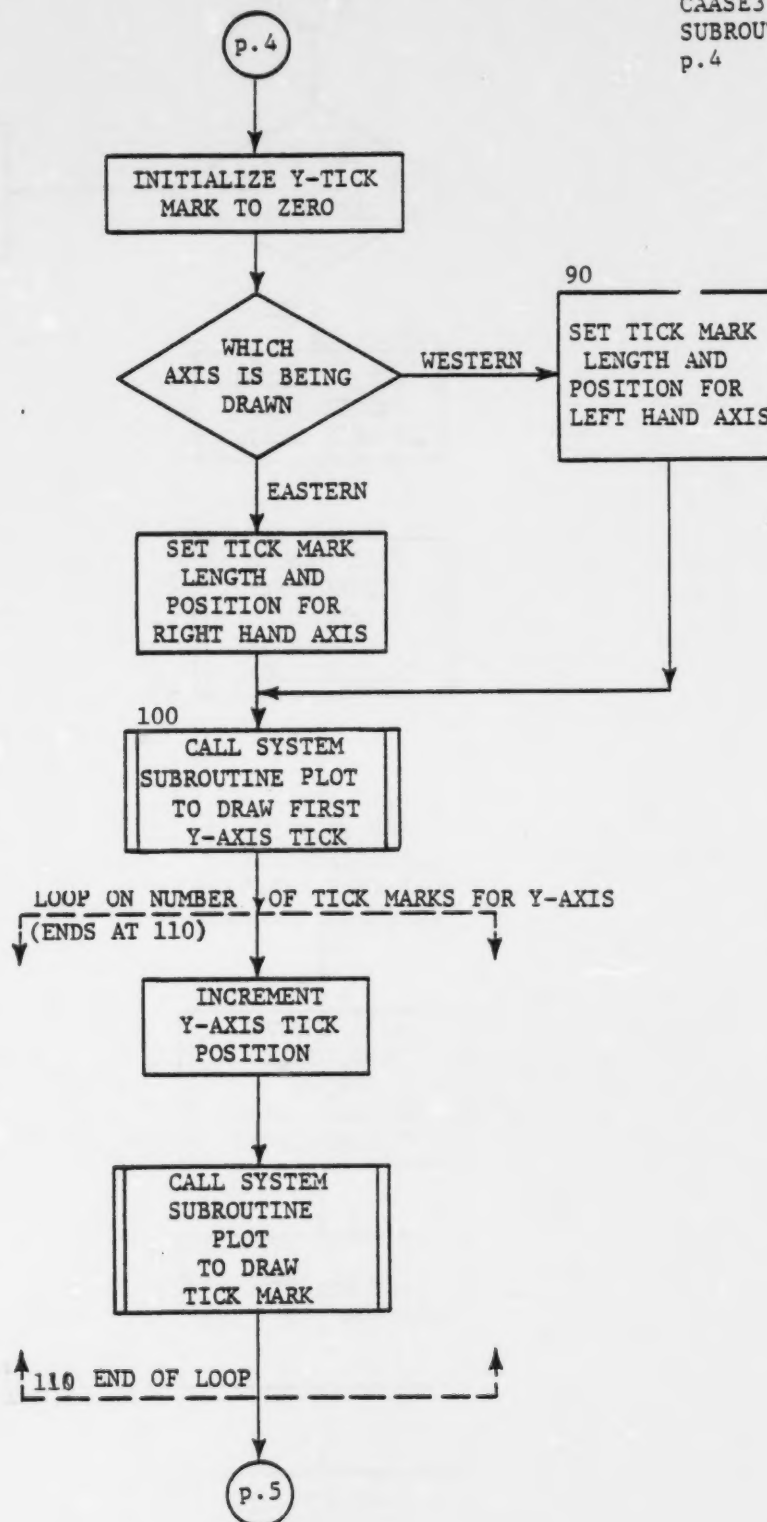


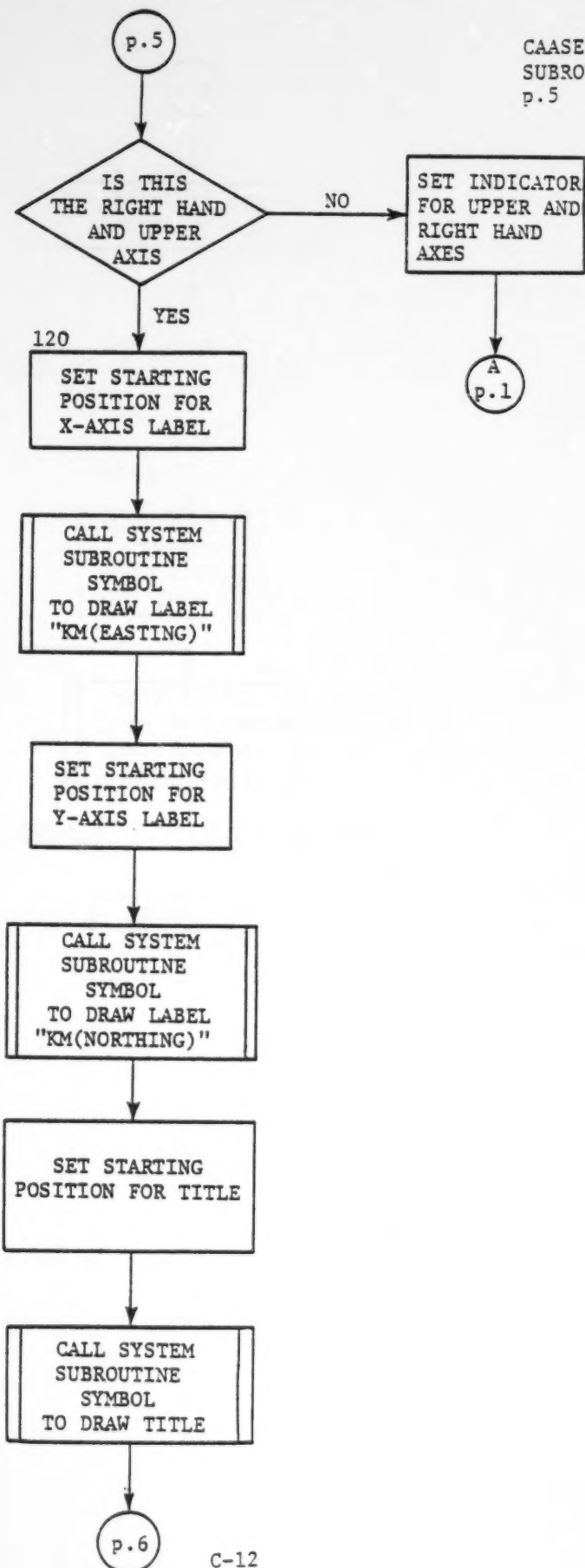


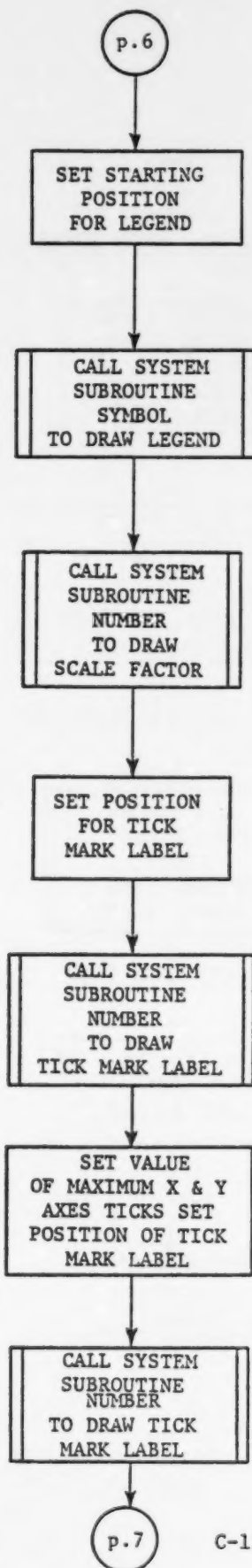


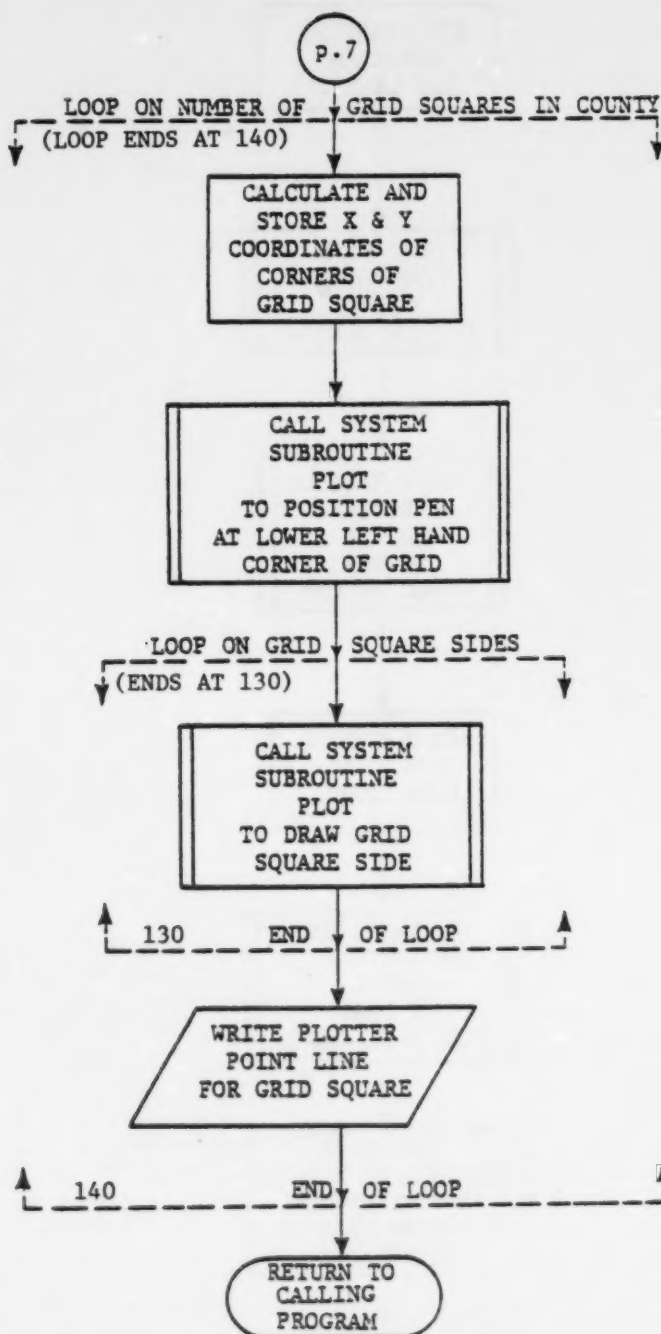


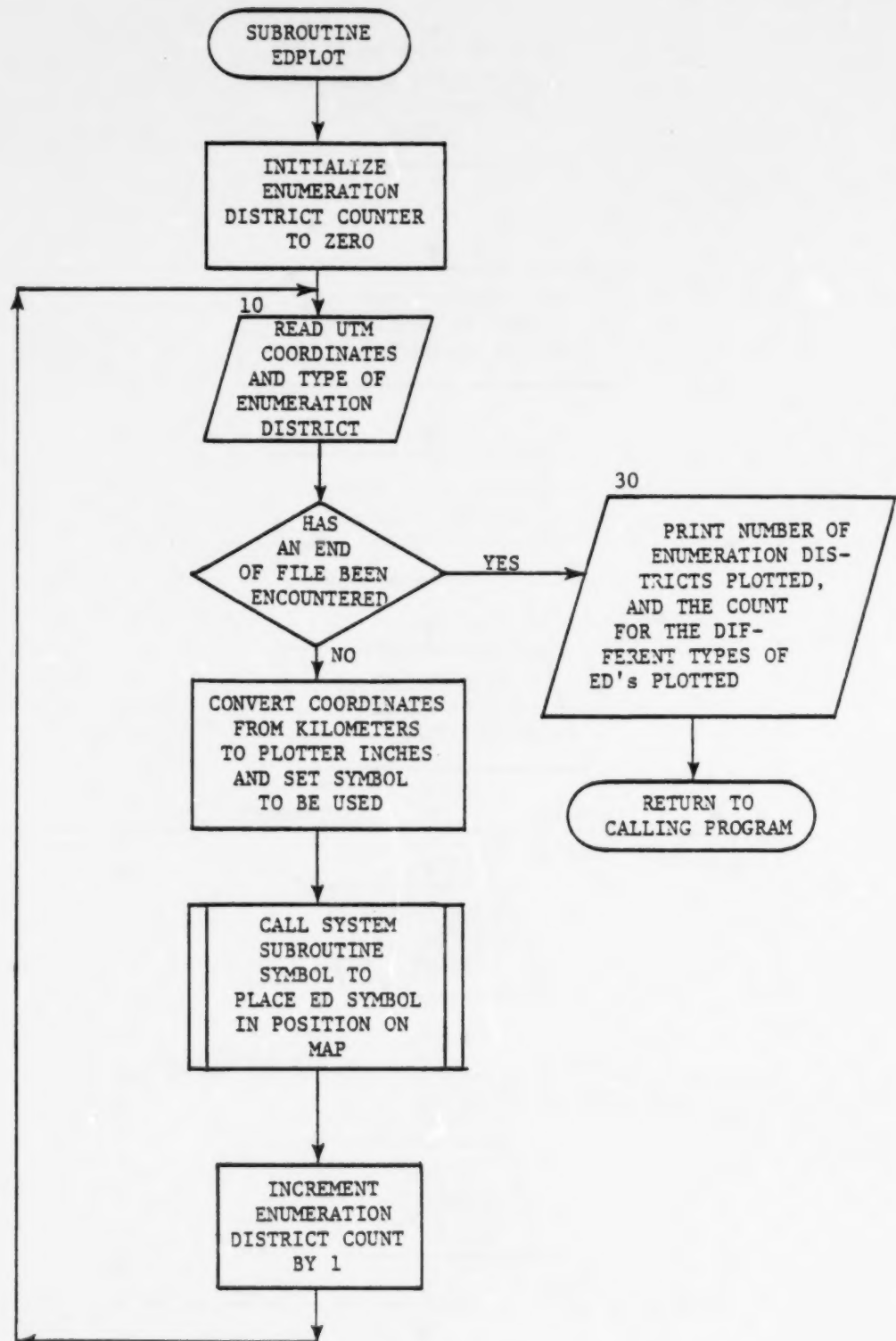


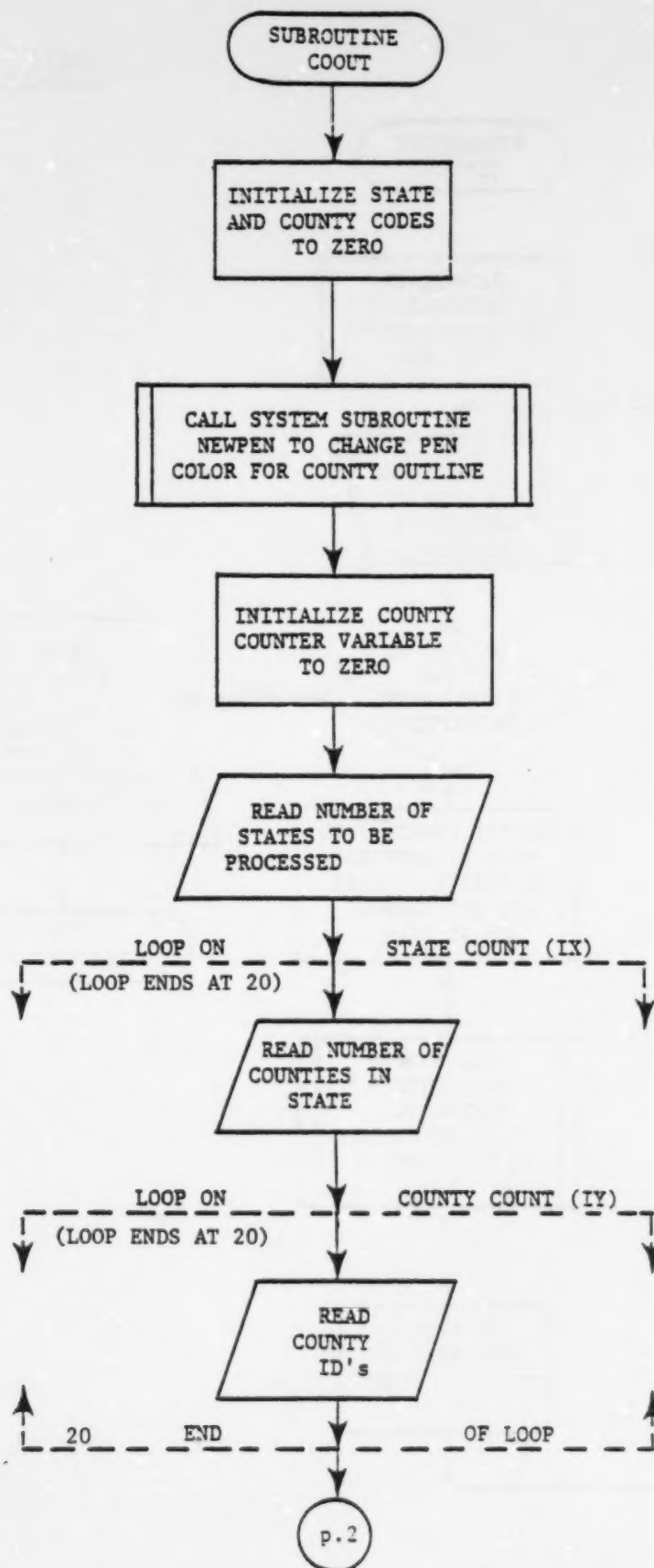


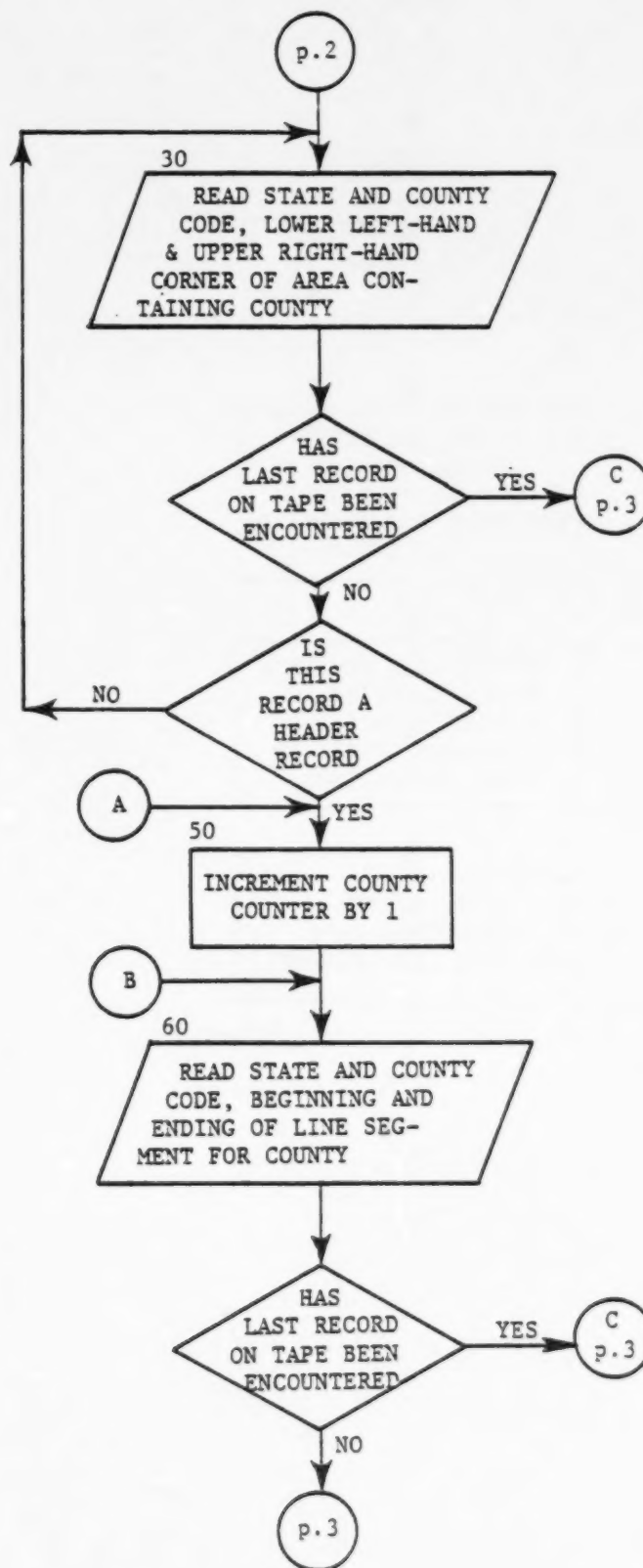


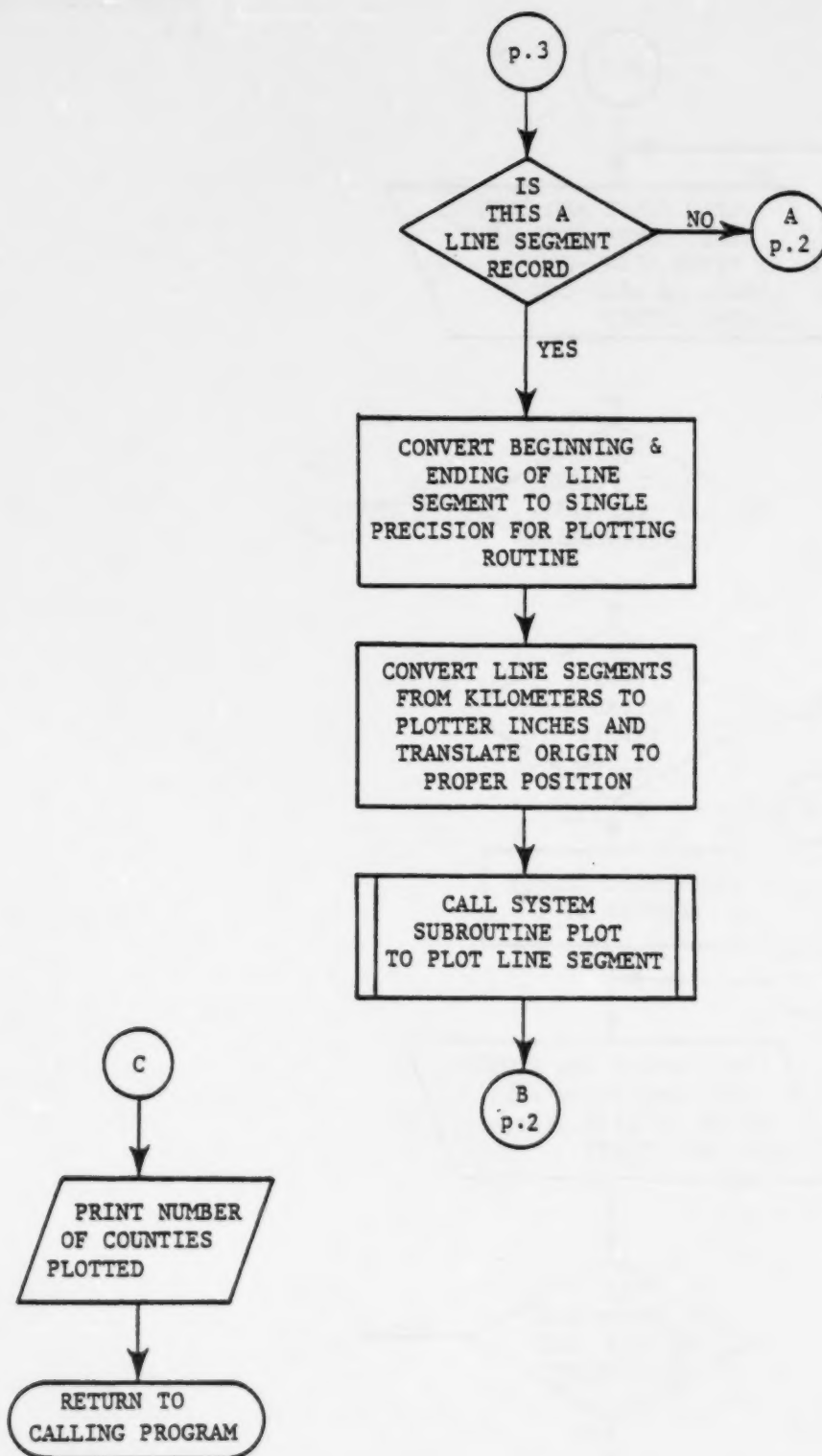













```

10 READ (IREAD,20,END=140) SCALEX,IXER,ICO
20 FORMAT (F12.0,2I12)
30 READ (IREAD,30) AQCR
40 FORMAT (3A6,A2)
50 WRITE (IPRINT,40) AQCR
60 WRITE ('1',10X,'STUDY AREA IS ',JA6,A2)
70 IF (IXER.GT.0) WRITE (IPRINT,50)
80 FORMAT ('0ENUMERATION DISTRICTS TO BE PLOTTED')
90 IF (ICO.GT.0) WRITE (IPRINT,60)
100 FORMAT ('0COUNTY OUTLINES TO BE PLOTTED')
110 SCALEF=SCALEX
120 SCALEX=1/SCALEF
130 READ (NAQ,70,END=140) FROM,TU
140 FORMAT (4F5.0)
150 IT=FROM(1)/5.
160 XZERO=IT*5.
170 IT=FROM(2)/5.
180 YZERO=IT*5.
190 IT=TU(1)/5.
200 XLONG=IT*5.
210 IT=TU(2)/5.
220 YLONG=IT*5.
230 IF ((XZERO-FROM(1)).GE.0.) XZERO=XZERO-5.
240 IF ((YZERO-FROM(2)).GE.0.) YZERO=YZERO-5.
250 IF ((XLONG-TU(1)).LE.0.) XLONG=XLONG+5.
260 IF ((YLONG-TU(2)).LE.0.) YLONG=YLONG+5.
270 IXTIC=(XLONG-XZERO)/TICINC+1
280 IYTIC=(YLONG-YZERO)/TICINC+1
290 I1=IXTIC*TICINC/SCALEX
300 I2=IYTIC*TICINC/SCALEX
310 WRITE (IPRINT,80) FROM(1),FROM(2),TU(1),TU(2),I1,I2
320 FORMAT (/11X,'EASTING NORTHING',/, 'MINIMUM',2F10.0,/, 'MAXIMUM',2F10.0,/, 'INCHES')
330 C*****READ IN CARDS WITH BOX NO., X,Y-COORDINATES OF LLH, AND SIDE
340 C LENGTH UNTIL A BLANK CARD IS REACHED.
350 WRITE (IPRINT,90)
360 FORMAT ('0',/X,'BOX XPOINT YPOINT SIDE STATE COUNTY00007400

```

```

1',/)
DO 120 I=1,1800
  READ (NAQ,100,END=130) IBOX,(CNTY(J),J=1,2),IRZONE,XPT,YPT,S
  FORMAT (15,6X,13,15,13,2F10.5,F3.0)
  IF (IBOX.LE.0) GO TO 130
  N=1
  ID(1)=IBOX
  XRAY(1)=(XPT-XZERO)/SCALEX
  YRAY(1)=(YPT-YZERO)/SCALEX
  SIDE(1)=S/SCALEX
  WRITE (IPRINT,110) IBOX,XPT,YPT,S,(CNTY(J),J=1,2)
  FORMAT (1X,19,3F10.1,2X,14,15)
110 CONTINUE
C
C*****MAY HAVE EXCEEDED MAXIMUM NUMBER OF BOXES
  READ (NAQ,100,END=130) IBOX
  IF (IBOX) 150,130,170
C
C*****MAY HAVE FILLED XRAY AND YRAY FOR THIS AREA.  TIME TO PLOT BOXES.
130 CONTINUE
  CALL PUPBOX
C*****OPTIONAL PLOT OF ENUMERATION DISTRICTS.
  IF (IXER.GT.0) CALL EDPLT
C*****OPTIONAL PLOT OF COUNTY OUTLINES.
  IF (ICU.GT.0) CALL COOUT
  GO TO 10
C
140 WRITE (IPRINT,150)
150 FORMAT ('1GOOD FINISH')
C*****TULLC PLOTTING FORM
C  CALL PICSIZ(0,0.)
C***** GENERAL PLOTTING FORM
  XLONG=(XLONG-XZERO)/SCALEX+3.0
  CALL PLOT (XLONG,1.0,999)
  STOP
160
170 WRITE (IPRINT,180)
180 FORMAT ('THERE ARE MORE BOXES THAN STORAGE ALLOCATED.  END JOB')

```

00011200
00011300
00011400

GO TO 160
END

C

```

SUBROUTINE POPBOX
  DIMENSION AQCR(4), XRAY(1800), YRAY(1800), SIDE(1800)
  DIMENSION XX(2), YY(2), X(5), Y(5)
  COMMON /BOXES/ XZERO,YZERO,SCALEX,AQCR,XRAY,YRAY,SIDE,N,XLONG,YLONG
  10,IXTIC,IYTIC,TICINC,IPRINT,JRZONE,SCALEF
  C*****SET CONSTANTS NEEDED FOR PLOTTER USING INPUT VALUES.
  C*****XLONG= TICINC * XMAX + 2 INCHES, YLONG= TICINC * YMAX + 3 INCHES.
  XTIC=IXTIC
  YTIC=IYTIC
  TICINC=TICINC/SCALEX
  XMAX=XTIC*TICINC
  YMAX=YTIC*TICINC
  SCALE=250000/SCALEF
  J=29
  I=29
  CALL PLUTS (I,J,14)
  CALL PLUT (0.,-30.,-3)
  CALL PLUT (3.0,0.75,-3)
  IND1=0

  C
  C*****DRAW THE X-AXIS.
  10  XX(1)=0.0
     XX(2)=XMAX
     IF (IND1.LE.0) GO TO 20
     YY(1)=YMAX
     YY(2)=YMAX
     GO TO 50
  20  YY(1)=0.0
     YY(2)=0.0
  30  CALL PLUT (XX(1),YY(1),3)
     CALL PLUT (XX(2),YY(2),2)
  C*****DRAW THE Y-AXIS.
     IF (IND1.LE.0) GO TO 40
     XX(1)=XMAX
     YY(2)=0.
     GO TO 50
  40  XX(2)=0.0

```


50	YY(2)=YMAX	00003800
	CALL PLOT (XX(1),YY(1),3)	00003900
	CALL PLOT (XX(2),YY(2),2)	00004000
	C*****PLOT TIC MARKS ON X-AXIS	00004100
	XX(1)=0.0	00004200
	IF (IND1.LE.0) GO TO 60	00004300
	YY(1)=YMAX	00004400
	YY(2)=YMAX+0.1*SCALEF	00004500
	GO TO 70	00004600
60	YY(1)=0.0	00004700
	YY(2)=-0.1*SCALEF	00004800
70	XX(2)=XX(1)	00004900
	CALL PLOT (XX(1),YY(1),3)	00005000
	CALL PLOT (XX(2),YY(2),2)	00005100
	DO 80 I00=1,IYTIC	00005200
	XX(1)=XX(1)+TICINC	00005300
	XX(2)=XX(1)	00005400
	CALL PLOT (XX(1),YY(1),3)	00005500
	CALL PLOT (XX(2),YY(2),2)	00005600
80	CONTINUE	00005700
	C*****PLOT TIC MARKS ON Y-AXIS	00005800
	YY(1)=0.0	00005900
	IF (IND1.LE.0) GO TO 90	00006000
	XX(1)=XMAX	00006100
	XX(2)=XMAX+0.1*SCALEF	00006200
	GO TO 100	00006300
90	XX(1)=0.0	00006400
	XX(2)=-0.1*SCALEF	00006500
100	YY(2)=YY(1)	00006600
	CALL PLOT (XX(1),YY(1),3)	00006700
	CALL PLOT (XX(2),YY(2),2)	00006800
	DO 110 I00=1,IYTIC	00006900
	YY(1)=YY(1)+TICINC	00007000
	YY(2)=YY(1)	00007100
	CALL PLOT (XX(1),YY(1),3)	00007200
	CALL PLOT (XX(2),YY(2),2)	00007300
110	CONTINUE	00007400

```

IF (IND1.EQ.1) GO TO 120
IND1=1
GO TO 10

C
C*****TIME TO PRINT LABELS.
120 START=(XMAX-1.6*SCALEF)/2.0
XX(1)=START
YY(1)=-0.34*SCALEF
CALL SYMBOL (XX(1),YY(1),0.15*SCALEF,'KM (EASTING)',0.0,13)
START=(YMAX-1.7*SCALEF)/2.0
YY(1)=START
XX(1)=-0.14*SCALEF
CALL SYMBOL (XX(1),YY(1),0.15*SCALEF,'KM (NORTHING)',90.0,14)

C*****TO CENTER THE TITLE, USE LENGTH OF 2ND. HEADG (3.2) AND OF
C THE MAJOR HEADG (4.6).
XSTART=(XMAX-7.8*SCALEF)/2.0
YSTART=(YMAX+0.3*SCALEF)
CALL SYMBOL (XSTART,YSTART,0.20*SCALEF,'AREA: ',0.0,7)
CALL SYMBOL (999.,999.,0.2*SCALEF,AQCR,0.0,20)
XSTART=(XMAX-3.2*SCALEF)
CALL SYMBOL (XSTART,YSTART,0.15*SCALEF,'SCALE: 1 KM:',0.0,13)
CALL NUMBER (999.,999.,0.15*SCALEF,SCALE,0.0,-1)
CALL SYMBOL (999.,999.,0.15*SCALEF,' KM',0.0,3)
XX(1)=-0.6*SCALEF
YY(1)=-0.3*SCALEF
CALL NUMBER (XX(1),YY(1),0.15*SCALEF,XZERO,0.0,4)
XX(1)=-1.5*SCALEF
YY(1)=-0.075*SCALEF
CALL NUMBER (XX(1),YY(1),0.15*SCALEF,YZERO,0.0,4)
EPN=(5.*XTIC)+XZERO
FPN=(5.*YTIC)+YZERO
YY(1)=(YMAX-0.075*SCALEF)
CALL NUMBER (XX(1),YY(1),0.15*SCALEF,FPN,0.0,4)
XX(1)=(XMAX-0.6*SCALEF)
YY(1)=-0.3*SCALEF
CALL NUMBER (XX(1),YY(1),0.15*SCALEF,EPN,0.0,4)

C

```

```

00007500
00007600
00007700
00007800
00007900
00008000
00008100
00008200
00008300
00008400
00008500
00008600
00008700
00008800
00008900
00009000
00009100
00009200
00009300
00009400
00009500
00009600
00009700
00009800
00009900
00010000
00010100
00010200
00010300
00010400
00010500
00010600
00010700
00010800
00010900
00011000
00011100

```

C*****TIME TO DRAW BOXES.
C

DU 140 K=1,N
X(1)=XRAY(K)
X(2)=X(1)
X(3)=XRAY(K)+SIDE(K)
X(4)=X(3)
X(5)=X(1)
Y(1)=YRAY(K)
Y(2)=YRAY(K)+SIDE(K)
Y(3)=Y(2)
Y(4)=Y(1)
Y(5)=Y(1)

C***** GENERAL PLOTTING FORM
CALL PLUT (X(1),Y(1),3)
DU 150 IDU=2,5
CALL PLUT (X(IDU),Y(IDU),2)
130 CONTINUE
140 CONTINUE
C RETURN
END

00011200
00011300
00011400
00011500
00011600
00011700
00011800
00011900
00012000
00012100
00012200
00012300
00012400
00012500
00012600
00012700
00012800
00012900
00013000
00013100
00013200
00013300


```

FRUMP(1)=(FRUMP(1)-XZERO)/SCALEX
FRUMP(2)=(FRUMP(2)-YZERO)/SCALEX
TOP(1)=(TOP(1)-XZERO)/SCALEX
TOP(2)=(TOP(2)-YZERO)/SCALEX
C***** GENERAL CALLS.
      CALL PLOT (FRUMP(1),FRUMP(2),3)
      CALL PLOT (TOP(1),TOP(2),2)
C*****GO GET NEXT RECORD
      GO TO 80
C*****ALL COUNTIES FINISHED
70  WRITE (IPRINT,80) ICOUNT
80  FORMAT (15,' COUNTIES',' OUTLINES PLOTTED')
      RETURN
C
      END

```

```

00003800
00003900
00004000
00004100
00004200
00004300
00004400
00004500
00004600
00004700
00004800
00004900
00005000
00005100
00005200

```

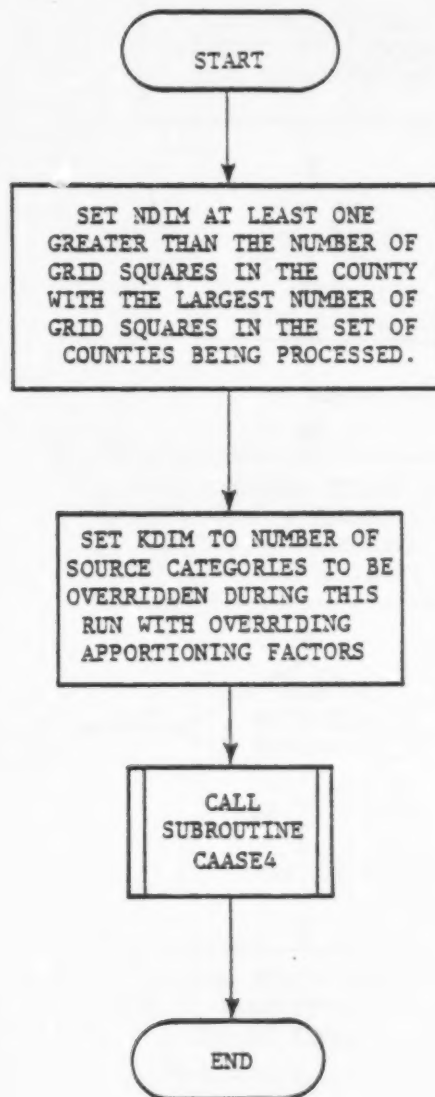
```

SUBROUTINE COUNT
COMMON /CO/ ICOFIL, FROM, TO
COMMON /BOXES/ XZERU, YZERU, SCALEX, DUMMY1(4), DUMMY2(1800), DUMMY3(1800000300
100), DUMMY4(1800), IDUM, XLONG, YLONG, DUM1, DUM2, DUM3, IPRINT, JRZONE, SCAU00000400
2LEF
DIMENSION FROMP(2), TOP(2), FROM(2), TO(2)
REAL*8 FROM, TO
1
ICITY=0
C*****PLU1 BOUNDARIES OF EACH COUNTY. FIRST, CHANGE PEN TO BLUE.
C
C    CALL NEWPEN (3)
C*****BEGIN COUNTY-BY-COUNTY LOOP.
ICOUNT=0
C*****FIND BEGINNING COUNTY RECORD ON TAPE.
C*****FIRST SKIP HEADER RECORDS.
10 READ (ICOFIL,10) IX
FORMAT (I4)
DO 20 I=1,IX
READ (ICOFIL,10) IY
DO 20 J=1,IY
READ (ICOFIL,10) IZ
CONTINUE
20 READ (ICOFIL,40,END=70) IST,ICTY,FROM,TO
30 FORMAT (I7,I3,4F10.1)
40 IF (IST.EQ.0.OR.ICTY.EQ.0) GO TO 50
C*****COUNTY HEADER FOR COUNTY I FOUND.
50 ICOUNT=ICOUNT+1
C*****PLU1 COUNTY.
60 READ (ICOFIL,40,END=70) IST,ICTY,FROM,TO
C*****CHECK FOR NEW COUNTY.
IF (IST.NE.0) GO TO 50
FROMP(1)=FROM(1)
FROMP(2)=FROM(2)
TOP(1)=TO(1)
TOP(2)=TO(2)
C*****PLU1 LINE SEGMENT

```

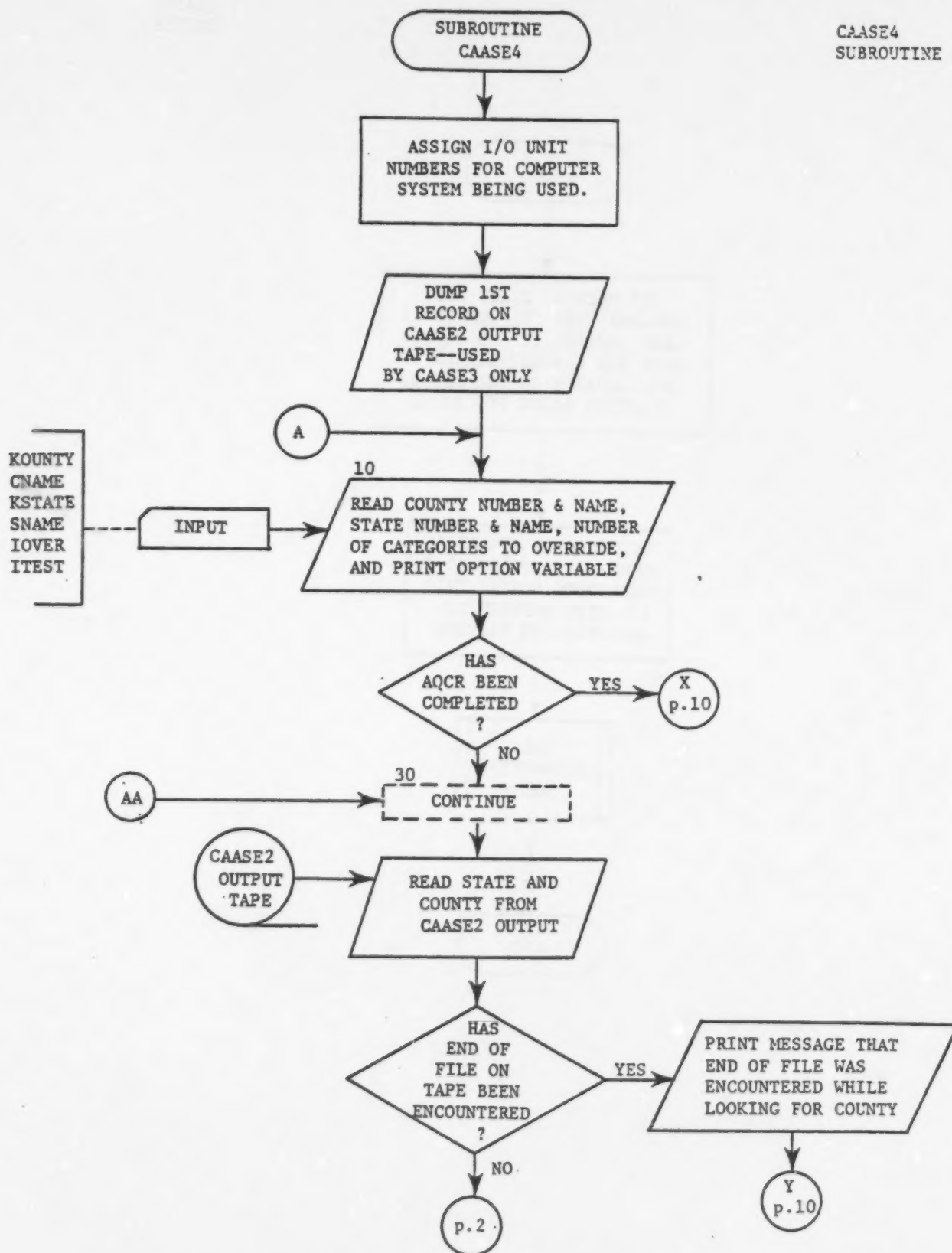

APPENDIX D

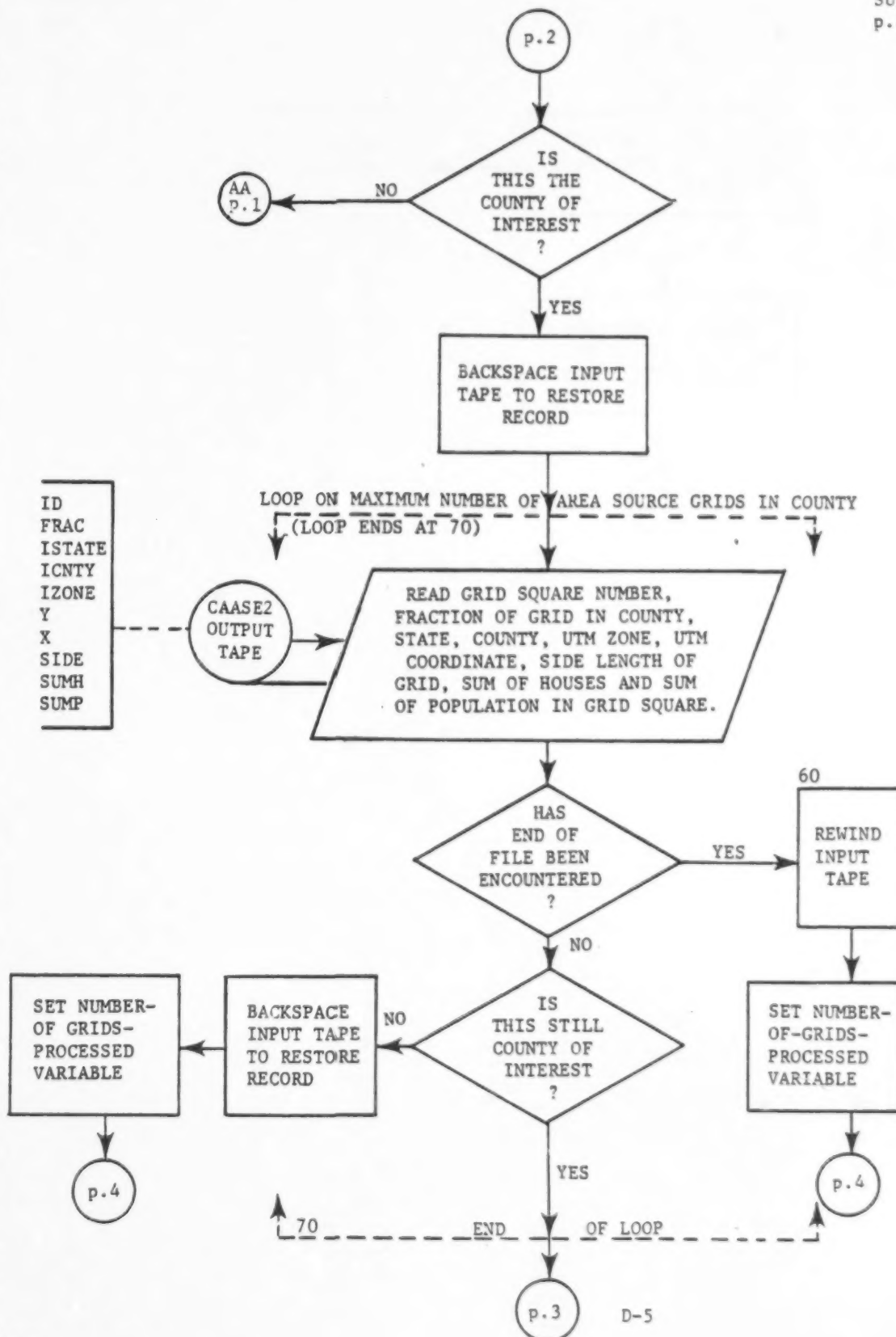
LOGICAL FLOWCHARTS AND FORTRAN SOURCE CODE LISTINGS
CAASE4 (and Subroutines)

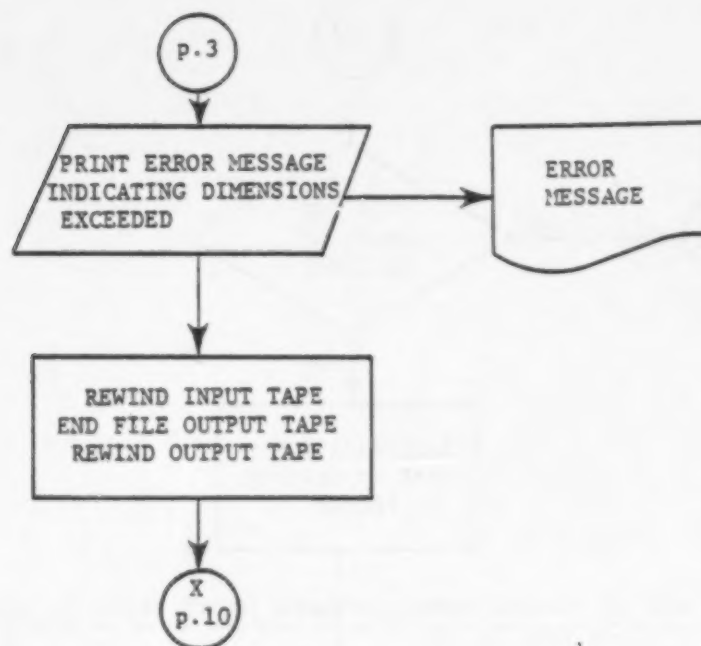


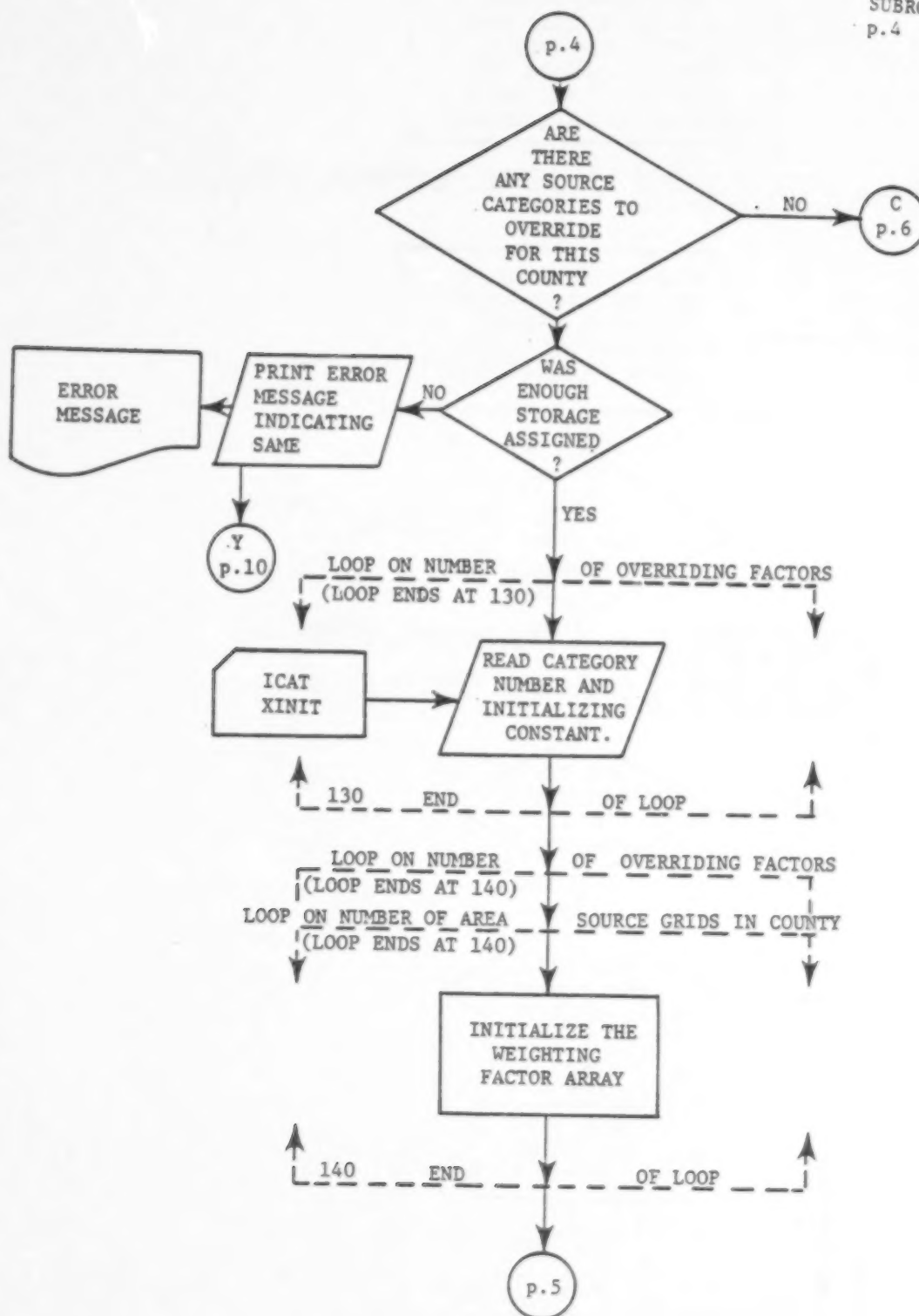
SUBROUTINE
CAASE4

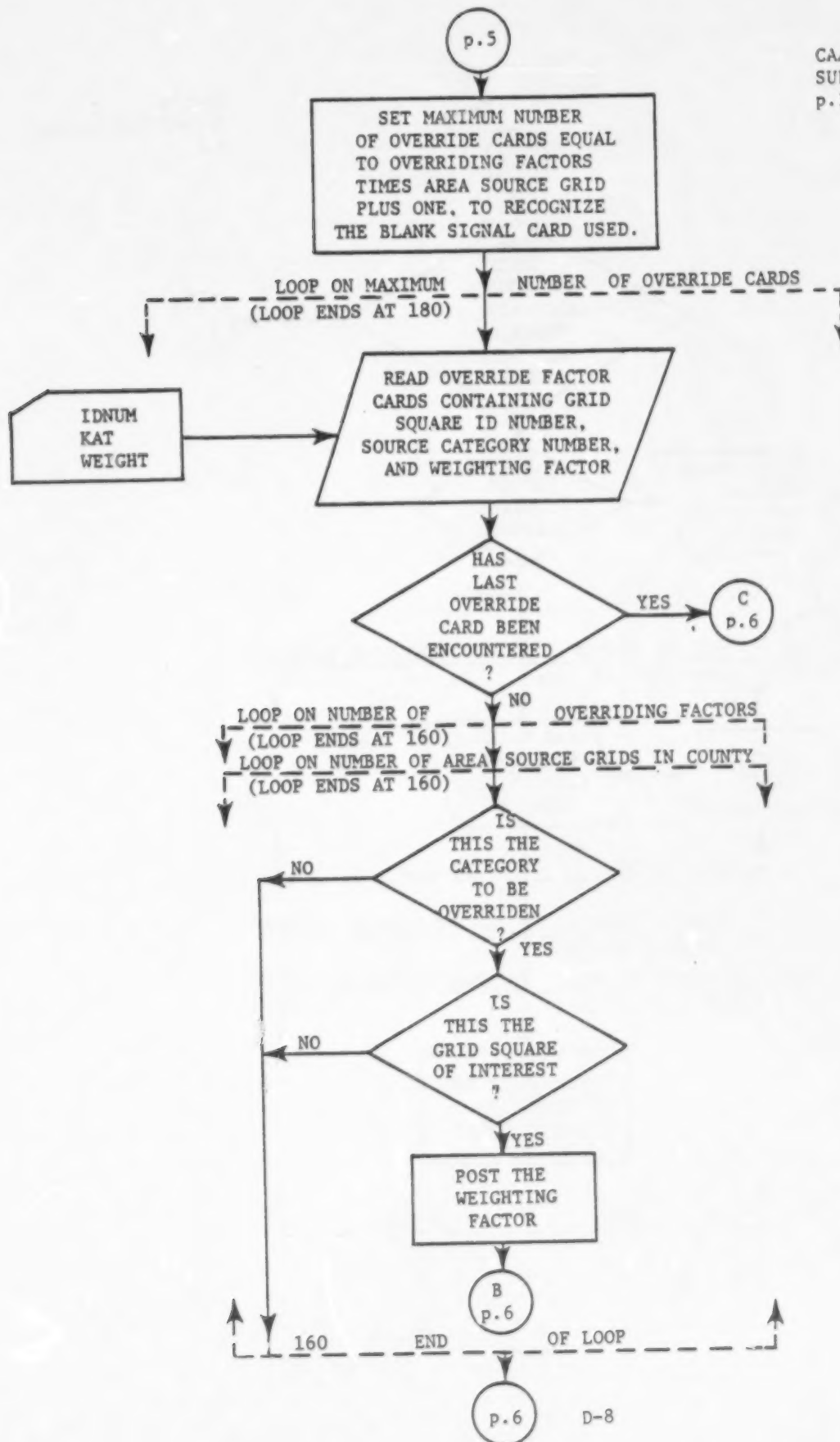
CAASE4
SUBROUTINE CAASE4

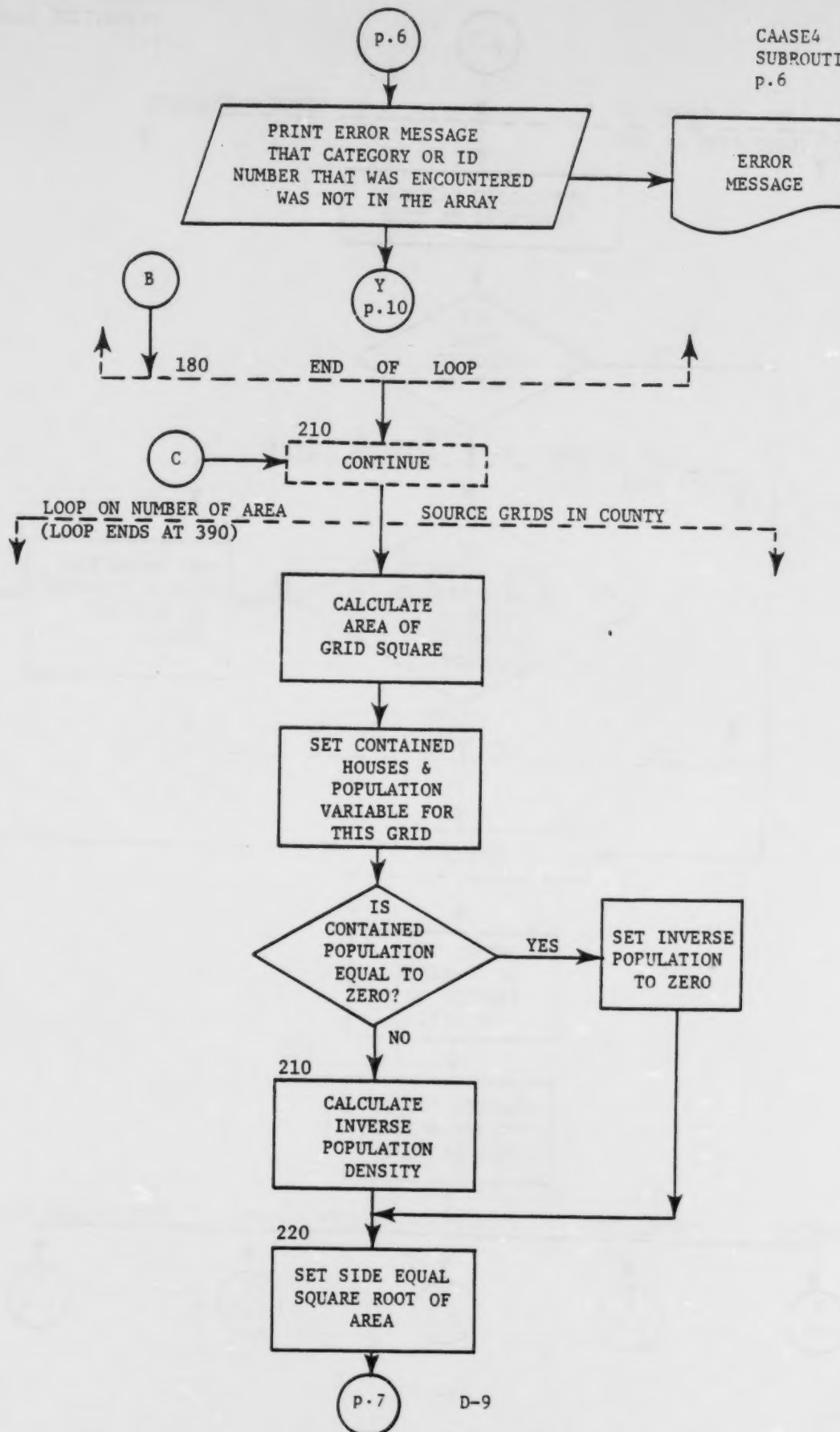


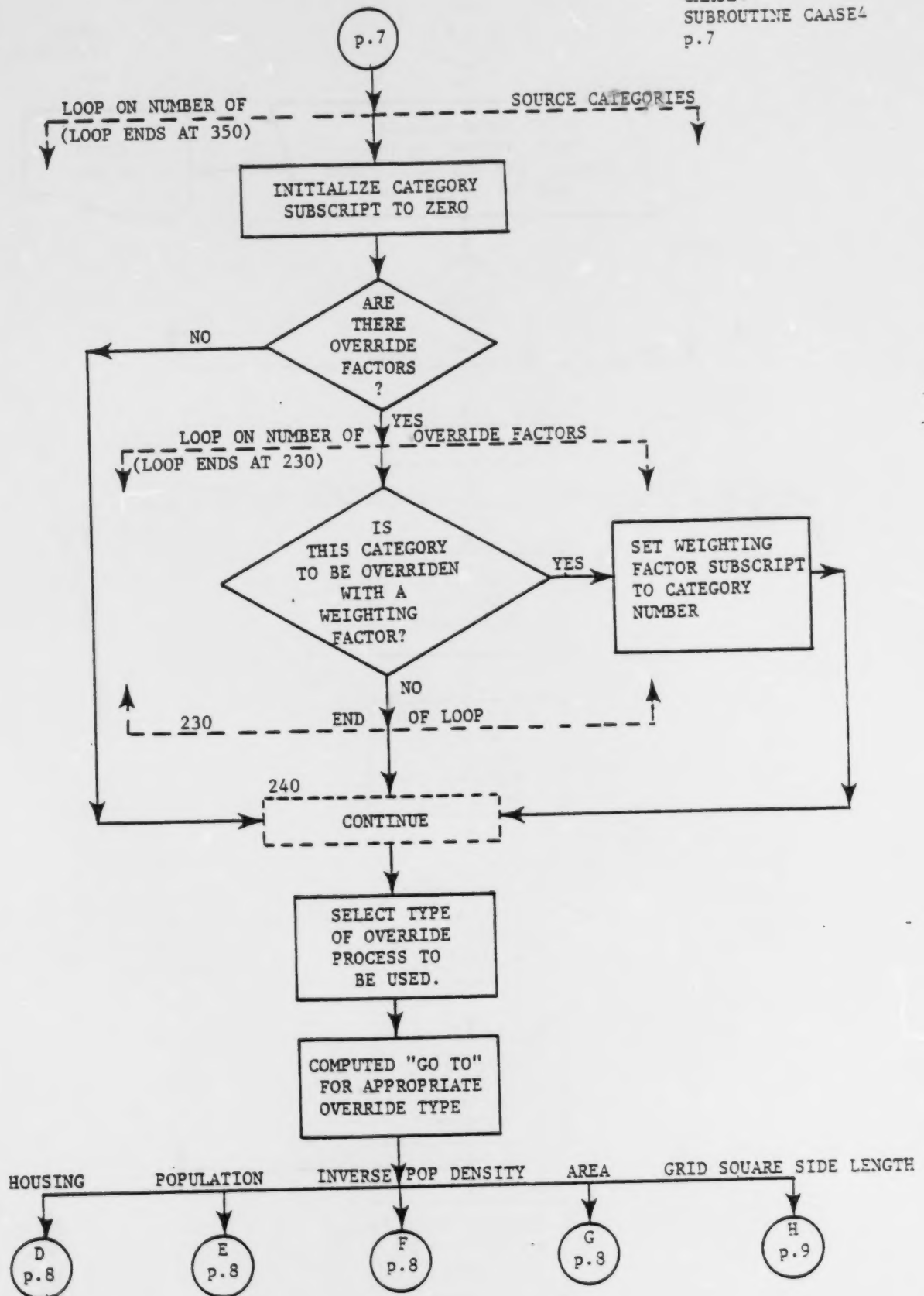


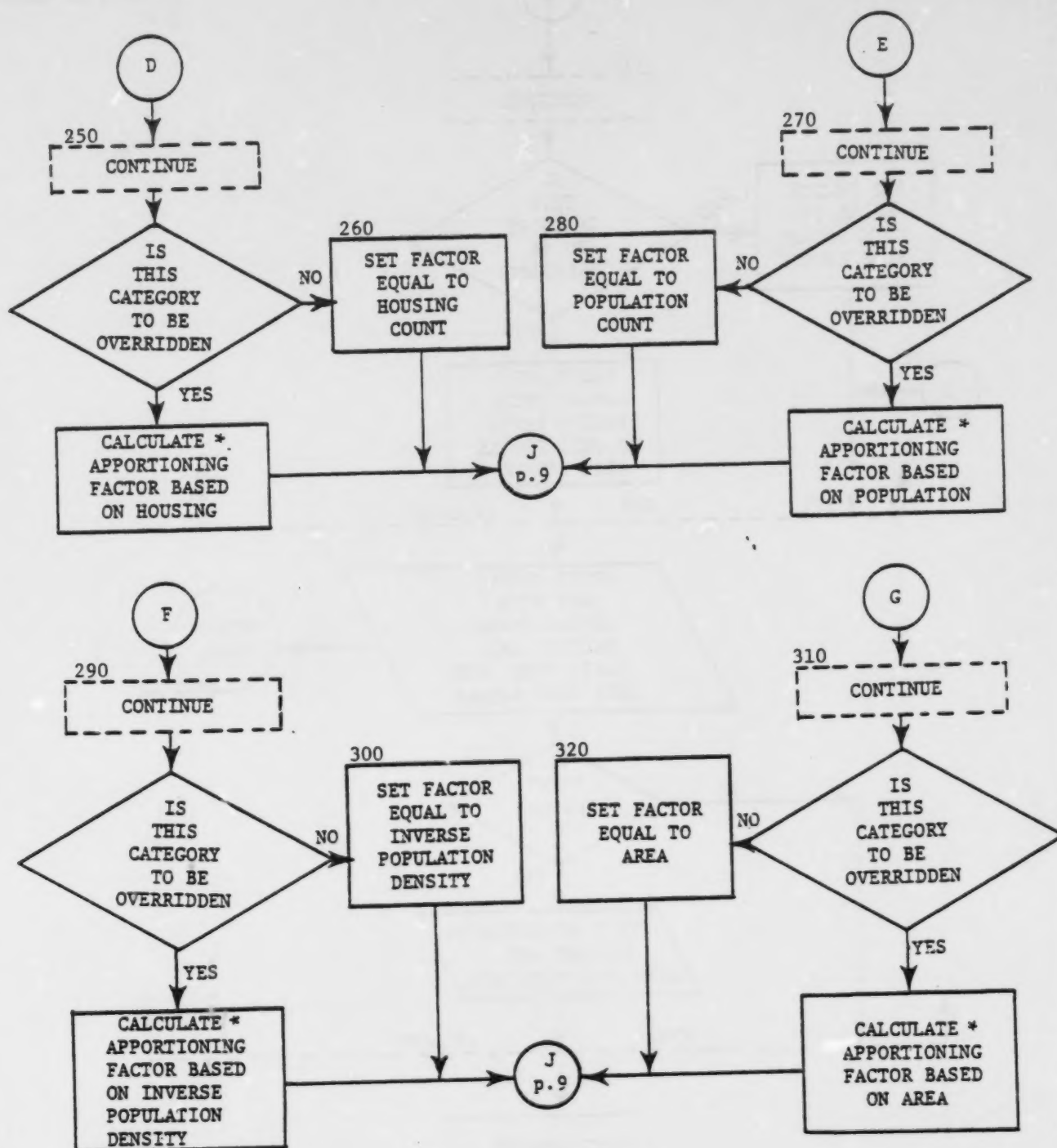




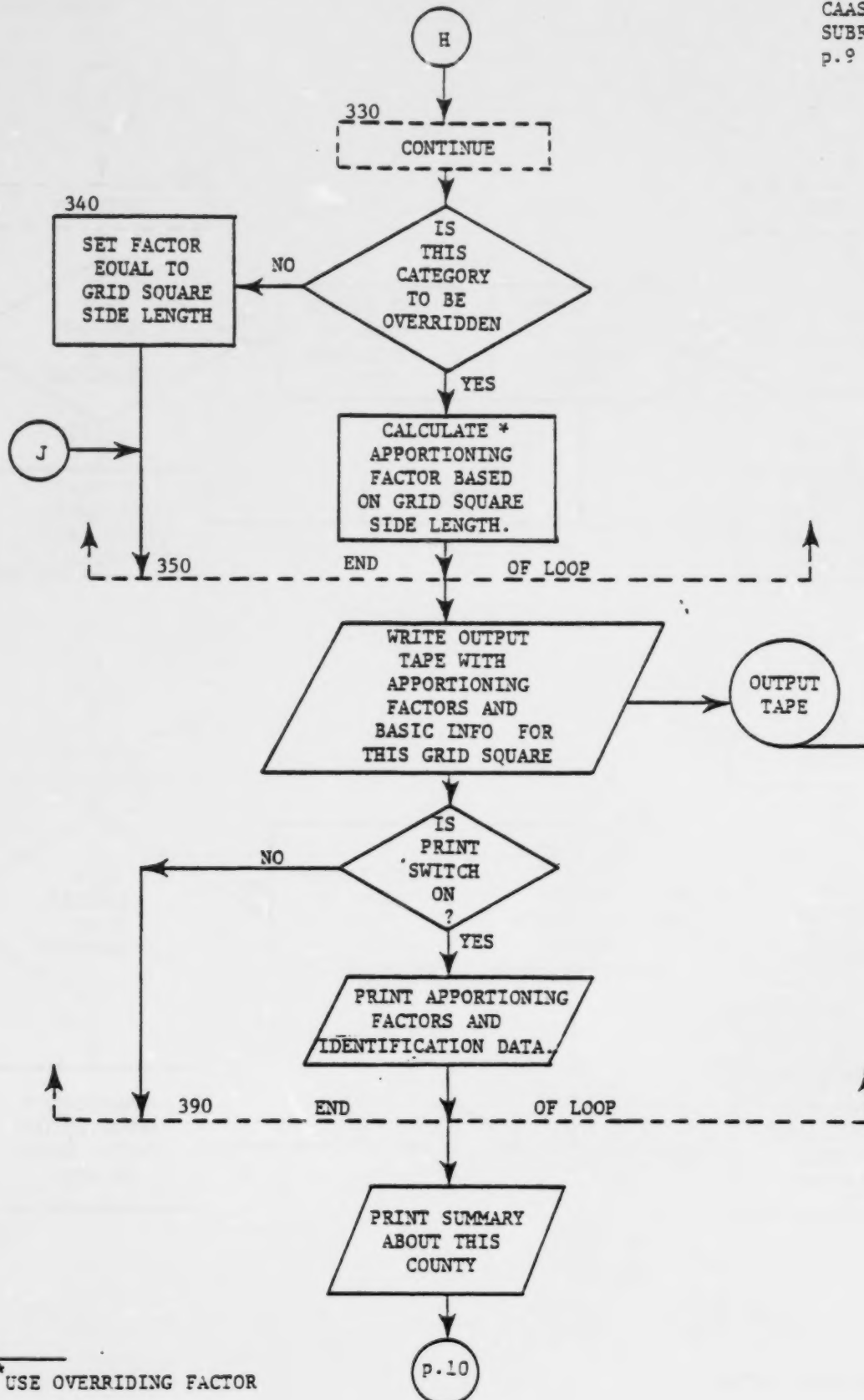




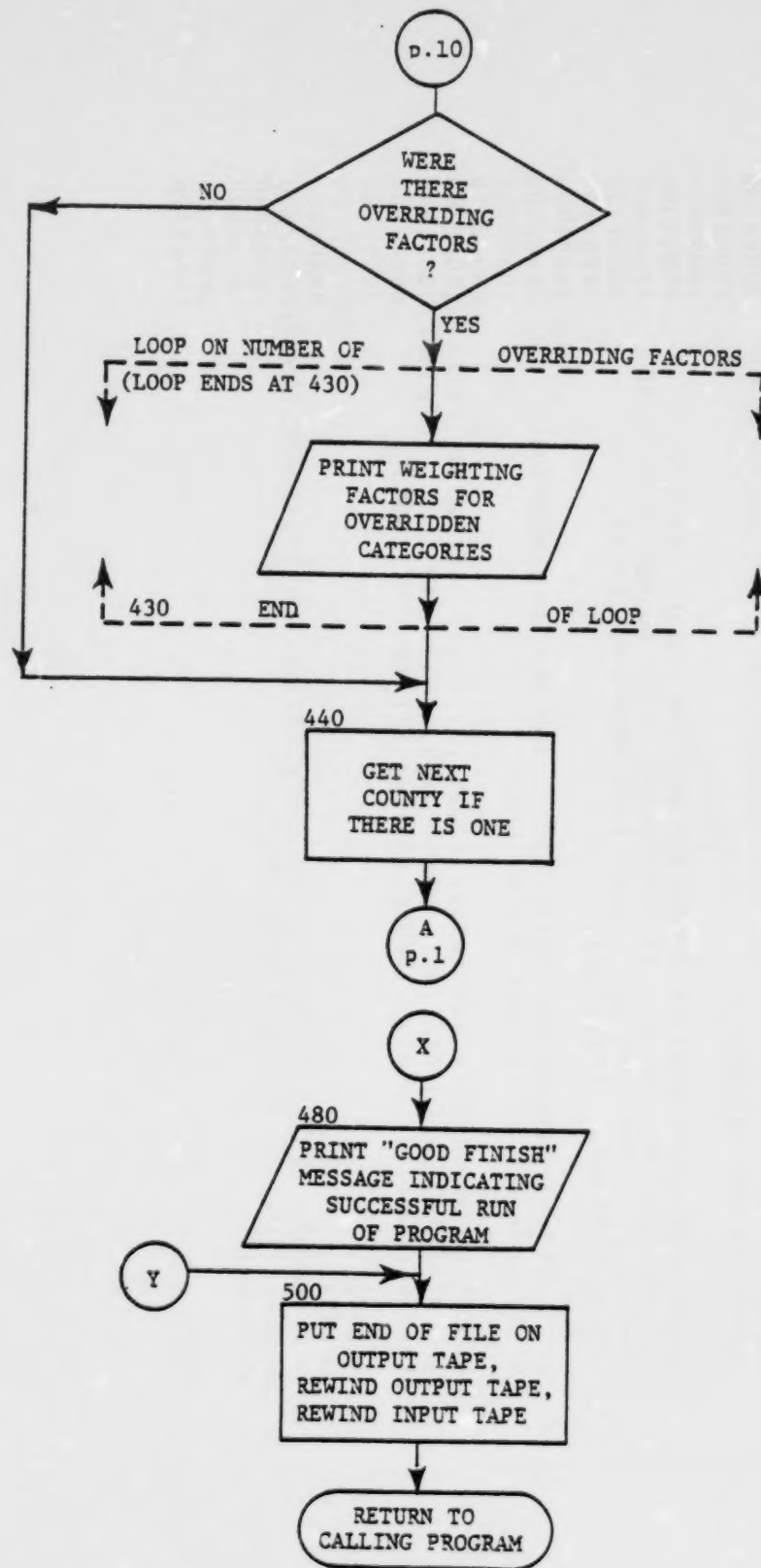




* USE OVERRIDING FACTOR



* USE OVERRIDING FACTOR




```

SUBROUTINE CAASE4 (ID,SUMH,SUMP,X,Y,SIDE,FRAC,STATE,COUNTY,ISTATE,00000100
1ICNTY,UTZONE,IZONE,WGIFCT,ICAT,XINIT,NDIM,KDIM)00000200
C**** ROUTINE READS TAPE WRITTEN BY CAASE2 WHICH INCLUDES:00000300
C GRID SQUARE ID NUMBERS (ID)00000400
C UTM COORDINATES (EASTING AND NORTHING) OF LOWER LEFT HAND00000500
C CORNER FOR EACH GRID SQUARE (X AND Y)00000600
C UTM ZONE FOR EACH GRID SQUARE (UTZONE)00000700
C SIDE LENGTH IN KILOMETERS FOR EACH GRID SQUARE (SIDE)00000800
C FRACTION (FRAC) OF EACH GRID SQUARE IN COUNTY, ASSIGNED GT00000900
C ZERO, LE TO 1.00001000
C STATE & COUNTY ASSOCIATED WITH EACH GRID SQUARE (STATE AND00001100
C COUNTY) FIPS CODE00001200
C DIMENSION SUMH(NDIM), SUMP(NDIM), ID(NDIM), X(NDIM), Y(NDIM), FRAC00001300
1(NDIM), SIDE(NDIM), ISTATE(NDIM), ICNTY(NDIM), IZONE(NDIM), WGIFCT00001400
2(NDIM,KDIM), CNAME(S), SNAME(S), ICAT(KDIM), XINIT(KDIM), FACTOR(500001500
30), HAPURT(S0)00001600
C**** ALSO PASSED TO ROUTINE ARE THE DIMENSIONS FOR THE RUN WHERE:00001700
C NDIM=NUMBER OF GRID SQUARES IN THE COUNTY WITH THE LARGEST00001800
C NUMBER OF SQUARES FOR THIS RUN (PLUS ONE)00001900
C KDIM=NUMBER OF SOURCE CATEGORIES TO BE OVERRIDEN00002000
C00002100
C ITEST = WHETHER OR NOT TO PRINT THE FACTORS COMPUTED - IF NOT00002200
C ZERO, PRINTING WILL OCCUR.00002300
C**** WEIGHT FACTORS ARE ASSUMED TO BE EQUAL TO 1.0 EXCEPT FOR00002400
C THOSE CATEGORIES TO BE OVERRIDEN.00002500
C00002600
C FOR THOSE SOURCE CATEGORIES TO BE OVERRIDEN, READ IN THE00002700
C SOURCE CATEGORY NUMBER AND EITHER A ZERO OR A 1.0 FOR00002800
C INITIALIZATION, E.G. IF AIRPORT OPERATIONS ARE TO BE00002900
C OVERRIDEN AND EMISSIONS APPORTIONED TO ONLY THOSE GRID00003000
C SQUARES INDICATED, THEN READ IN A CARD WITH EACH APPLICABLE00003100
C CATEGORY NUMBER (33,34, OR35) AND A 0.0 TO CAUSE THE00003200
C INITIALIZATION OF THE WEIGHTING FACTOR FOR EACH GRID SQUARE00003300
C TO BE SET TO ZERO...00003400
C00003500
C**** AN INPUT CARD TO OVERRIDE AN OBJECTIVE WEIGHTING FACTOR00003600
C REQUIRES THE GRID SQUARE ID NUMBER, THE SOURCE CATEGORY NUMBER,00003700

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C AND THE WEIGHT ASSIGNED- WEIGHTS OF 0 TO 10 OR 0.0 TO 1.0 ARE
C SUGGESTED
C
C SET GO TO BRANCHES AS A FUNCTION OF SOURCE CATEGORY
C
C DATA MAPORT /6*1,14*2,1,2*2,1,5*2,3,2,3,5,3*4,4*5,2*2,2*3,2*2,2*3,
C 14,0*3,2/
C
C ***** DIMENSIONS ARE A FUNCTION OF THE NUMBER OF GRID SQUARES IN THE
C COUNTY BEING PROCESSED (NDIM) AND THE NUMBER OF SOURCE CATEGORIES
C TO BE OVERRIDDEN (KDIM). THE USER IS CAUTIONED TO PROVIDE AN
C ADEQUATE NUMBER, E.G., IF THE LARGEST NUMBER OF SQUARES IN ANY
C COUNTY BEING PROCESSED IS 50, THEN DIMENSIONS SHOULD BE NO LESS
C THAN 51, AND THE VARIABLE 'NDIM' SHOULD BE SET TO 50
C
C ASSIGN I/O UNIT NUMBERS
C
C IREAD=5
C
C INPUT TAPE (FROM CAASE2)
C
C ITAPE=4
C
C OUTPUT TAPE (INPUT TO CAASE5)
C
C ITAPE=8
C IPRINT=0
C NDIM=NDIM+1
C
C START PROCESSING A COUNTY
C
C READ COUNTY AND STATE NAME AND NUMBER (FIPS-CENSUS), NUMBER OF
C CATEGORIES TO OVERRIDE, AND WHETHER PRINTER OUTPUT IS WANTED.
C
C SKIP DUMMY RECORD ON GRID INPUT (STUDY AREA LIMITS).

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```

00003800
00003900
00004000
00004100
00004200
00004300
00004400
00004500
00004600
00004700
00004800
00004900
00005000
00005100
00005200
00005300
00005400
00005500
00005600
00005700
00005800
00005900
00006000
00006100
00006200
00006300
00006400
00006500
00006600
00006700
00006800
00006900
00007000
00007100
00007200
00007300
00007400

```

C	READ (ITAPEN,20)	00007500
C	READ (LINEADR,20,END=460) KOUNTY,CNAME,KSTATE,SNAME,IUVER,ITEST	00007600
10	FORMAT (15,5X,5A4,15,5X,5A4,2I5)	00007700
20		00007800
C		00007900
C	STOP ON BLANK CARD FOR COUNTY (END OF RUN SIGNAL)	00008000
C		00008100
C	IF (KOUNTY.EQ.0) GO TO 480	00008200
C		00008300
C	READ IN CAASE2 OUTPUT DATA FOR COUNTY BEING PROCESSED. SHOULD	00008400
C	BE IN ORDER, I.E. COUNTIES IN ORDER AND ALL RECORDS FOR EACH	00008500
C	COUNTY IN SEQUENTIAL RECORDS, INSURE THAT NEXT RECORD IS COUNTY	00008600
C	WANTED	00008700
C	SUMH=SUM OF HOUSES IN EACH GRID SQUARE	00008800
C	SUMP=SUM OF POPULATION IN EACH GRID SQUARE	00008900
30	CONTINUE	00009000
C	READ (ITAPEN,40,END=460) JSTATE,JKNTY	00009100
40	FORMAT (11X,13,15)	00009200
C	IF (JSTATE.NE.KSTATE.OR,JKNTY.NE.KOUNTY) GO TO 30	00009300
C	FOUND COUNTY WANTED	00009400
C	BACKSPACE ITAPEN	00009500
C		00009600
C	READ DATA FOR THIS COUNTY, MAXIMUM WILL BE NDIM IN NUMBER	00009700
C		00009800
C		00009900
50	DO /O I=1,NDIMP1	00010000
C	READ (ITAPEN,50,END=60) ID(I),FRAC(I),ISTATE(I),ICNTY(I),IZONE(I),	00010100
C	IA(I),Y(I),SIDE(I),SUMH(I),SUMP(I)	00010200
C	FORMAT (15,F6.5,13,15,13,2F10.0,F3.0,2E13.5)	00010300
C	IF (ICNTY(I).EQ.KOUNTY.AND,ISTATE(I).EQ.KSTATE) GO TO 70	00010400
C		00010500
C	LETTER END OF FILE ENCOUNTERED OR ENCOUNTERED A DIFFERENT COUNTY	00010600
C	BACKSPACE ITAPEN	00010700
C		00010800
C		00010900
C	BACKS IS NUMBER OF GRID SQUARES THIS COUNTY	00011000
C		00011100

60	WAREAS=I-1	00011200
	GO TO 90	00011300
	REWIND ITAPEN	00011400
	WAREAS=I-1	00011500
70	GO TO 90	00011600
C	CONTINUE	00011700
C		00011800
C	ERROR, EXCEEDING DIMENSIONS REQUESTED, ERROR OFF	00011900
		00012000
80	WRITE (IPRINT,80) KOUNTY,CNAME,KSTATE,NAME,NDIM,NDIMP1	00012100
	FORMAT ('NUMBER OF GRID SQUARES CONTAINED IN',3X,15,5X,5A4,' COUNTO00012200	00012200
	IFY IN THE STATE OF',3X,15,5X,5A4,'EXCEEDS DIMENSIONS SPECIFIED',500012300	00012300
	2X,'NDIM=',15,5X,'AND',15,' GRID SQUARES HAVE BEEN READ WITHOUT EN00012400	00012400
	3COUNTERING EITHER','0ANOTHER COUNTRY OR AN END OF FILE, CORRECT NDI00012500	00012500
	4M AND RESUBMIT JOB')	00012600
90	GO TO 500	00012700
C	CONTINUE	00012800
C	ARE THERE ANY SOURCE CATEGORIES TO OVERRIDE FOR THIS COUNTRY	00012900
C		00013000
C		00013100
C	IF (IOVER.EQ.0) GO TO 200	00013200
C		00013300
C	READ THE CATEGORY NUMBER AND THE INITIALIZING CONSTANT (I.E. 1.0	00013400
C	OR 0.0) FOR EACH.	00013500
C		00013600
C		00013700
C	CHECK FIRST ON ENOUGH STORAGE ASSIGNED	00013800
C		00013900
		00014000
100	IF (IOVER.LE.NDIM) GO TO 110	00014100
	WRITE (IPRINT,100) IOVER,NDIM	00014200
	FORMAT ('NOT ENOUGH STORAGE ALLOCATED FOR OVERRIDE FACTORS, IOVER00014300	00014300
	1=',15,' AND NDIM=',15,'0 INCREASE NDIM AND RESUBMIT RUN')	00014400
	GO TO 500	00014500
110	DO 130 I=1,IOVER	00014600
	READ (IHEADR,120) ICAT(I),XINIT(I)	00014700
120	FORMAT (15,F5.0)	00014800
130	CONTINUE	

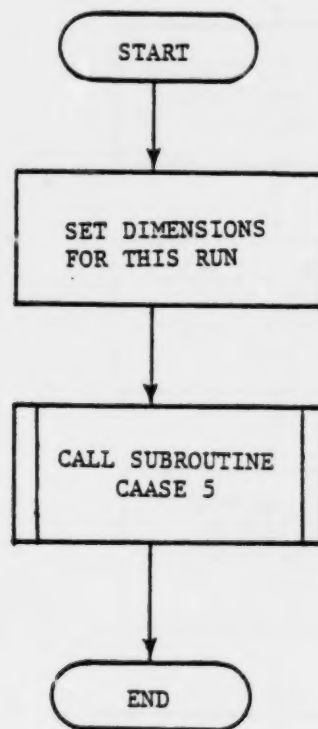
C	BRANCH ACCORDING TO WHICH CATEGORY ON THIS ITERATION	00026000
C		00026100
C		00026200
	I TYPE=NAPORT(J)	00026300
250	GO TO (250,270,290,310,350), I TYPE	00026400
C	CONTINUE	00026500
C		00026600
C	HOUSING	00026700
C		00026800
	IF (ISUB.EQ.0) GO TO 260	00026900
	FACIUR(J)=SUM1*WGIFCT(I,ISUB)	00027000
	GO TO 350	00027100
260	FACIUR(J)=SUM1	00027200
	GO TO 350	00027300
270	CONTINUE	00027400
C		00027500
C	POPULATION	00027600
C		00027700
	IF (ISUB.EQ.0) GO TO 280	00027800
	FACIUR(J)=SUM2*WGIFCT(I,ISUB)	00027900
	GO TO 350	00028000
280	FACIUR(J)=SUM2	00028100
	GO TO 350	00028200
290	CONTINUE	00028300
C		00028400
C	INVERSE POPULATION DENSITY	00028500
C		00028600
	IF (ISUB.EQ.0) GO TO 300	00028700
	FACIUR(J)=SUM3*WGIFCT(I,ISUB)	00028800
	GO TO 350	00028900
300	FACIUR(J)=SUM3	00029000
	GO TO 350	00029100
310	CONTINUE	00029200
C		00029300
C	AREA	00029400
C		00029500
	IF (ISUB.EQ.0) GO TO 320	00029600

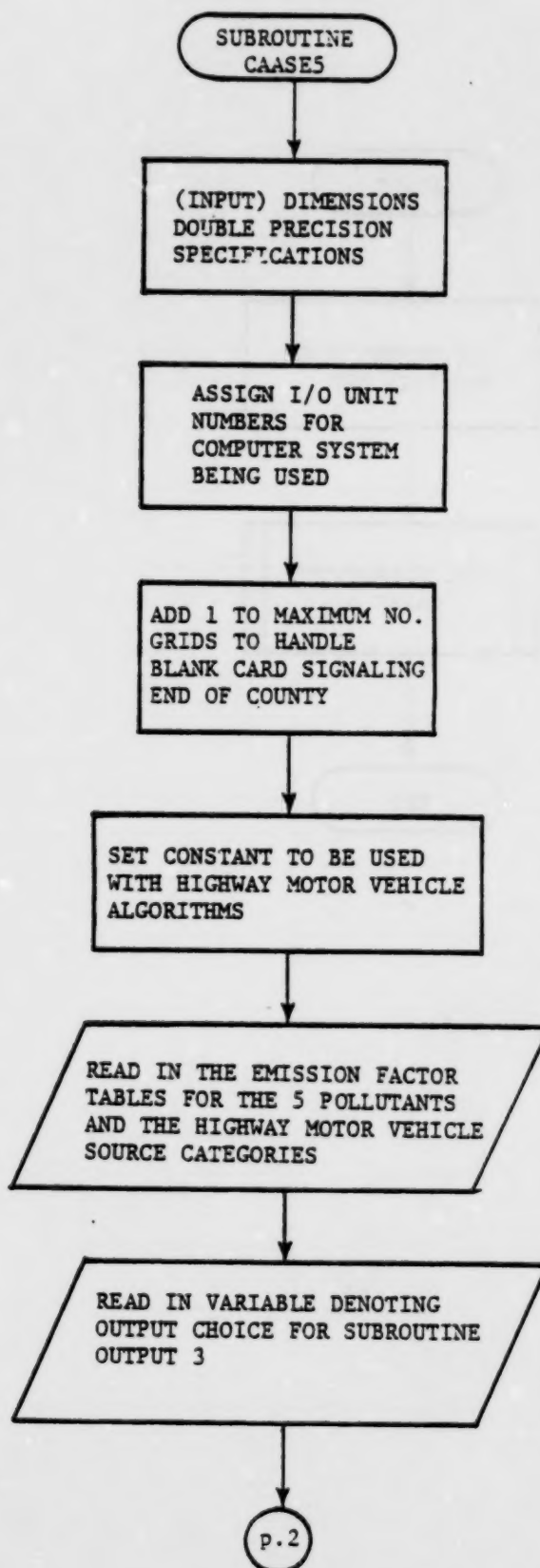
D-24

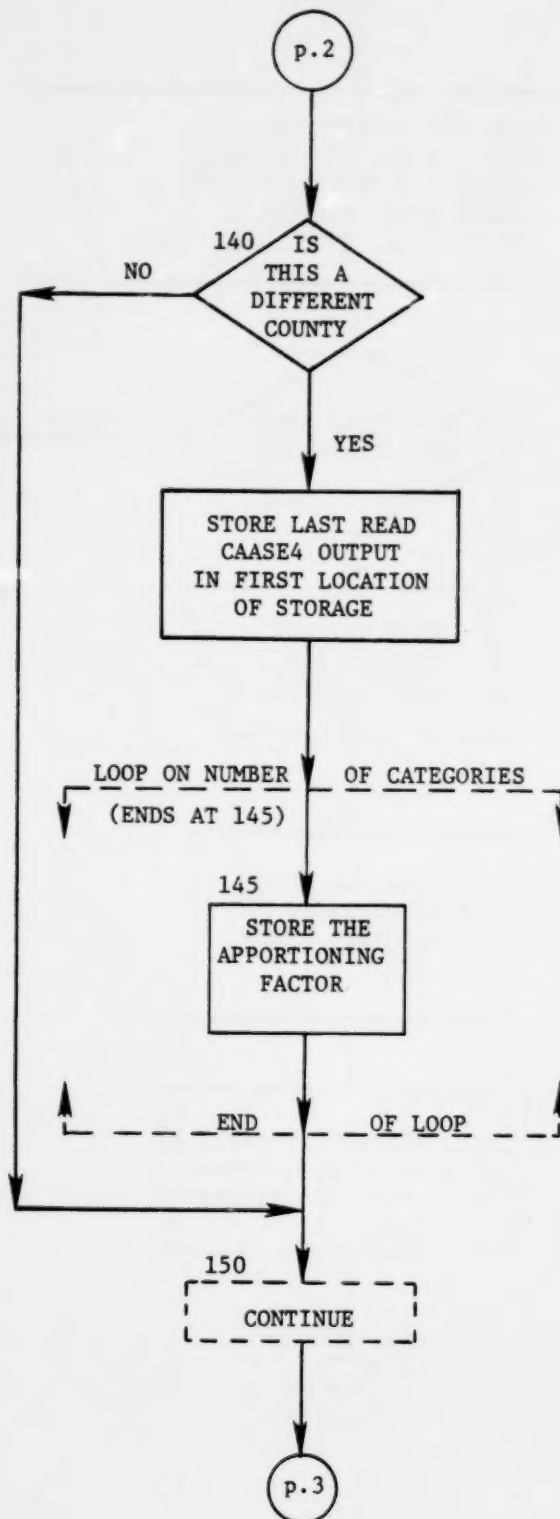
APPENDIX E

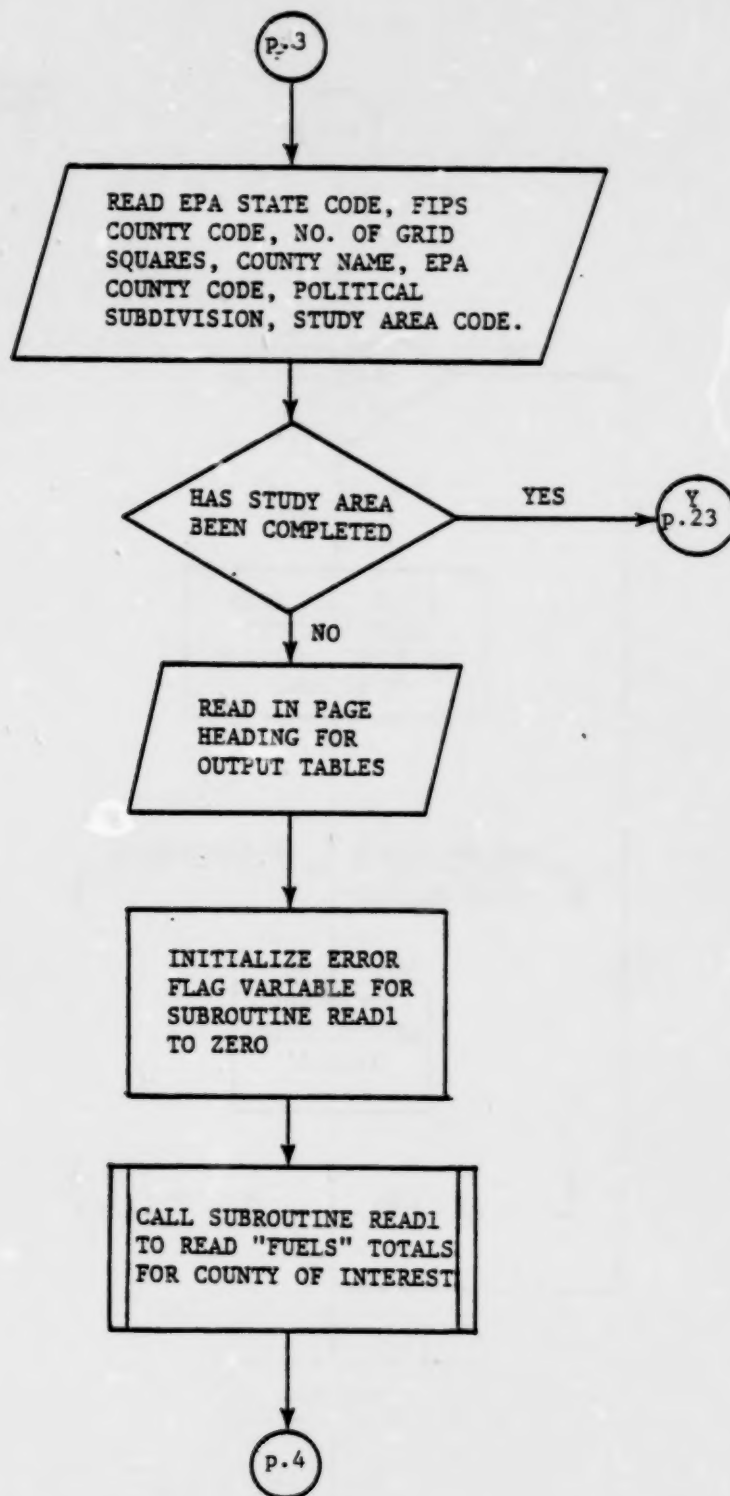
LOGICAL FLOWCHARTS AND FORTRAN SOURCE CODE LISTINGS

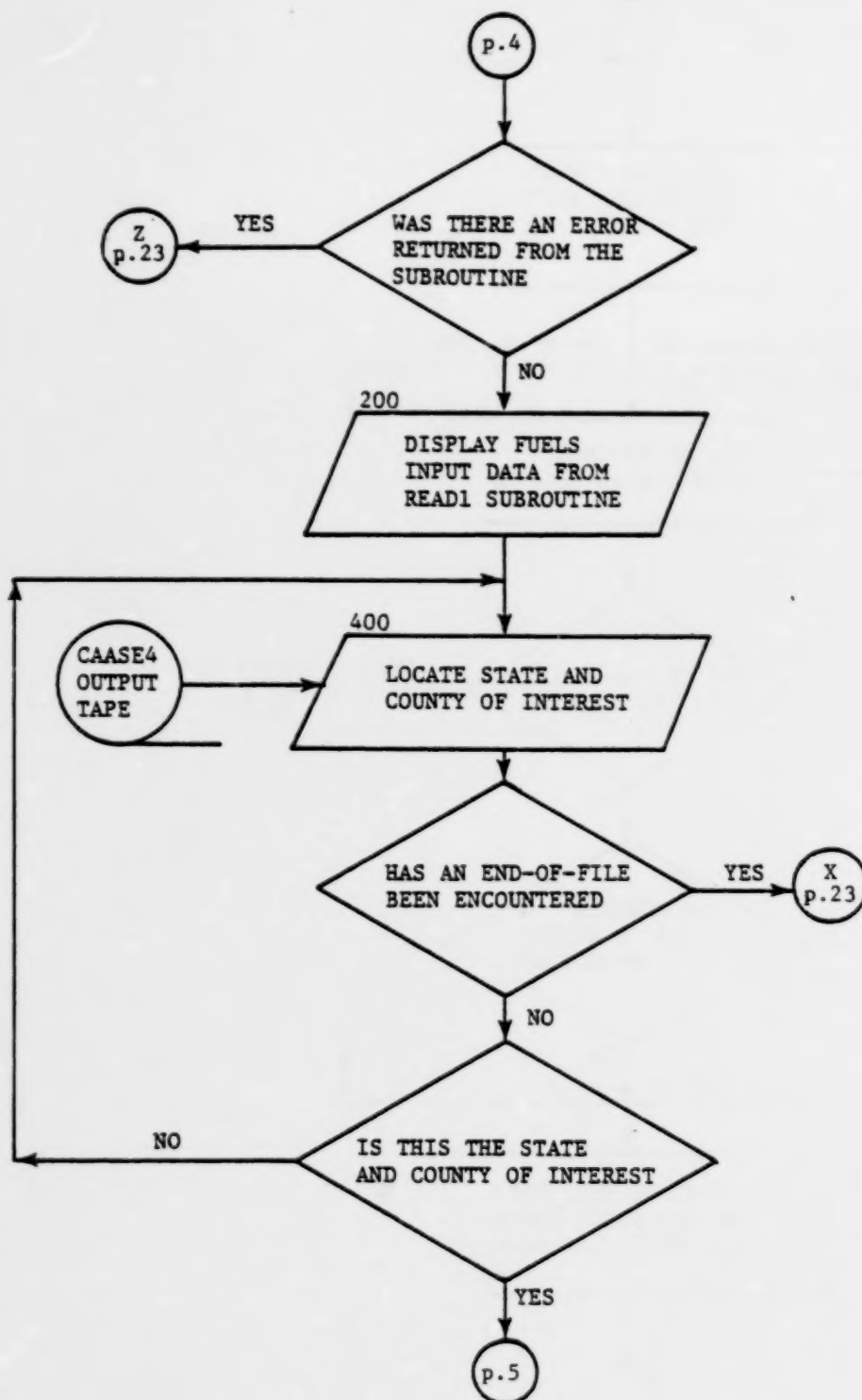
CAASE5 (and Subroutines)

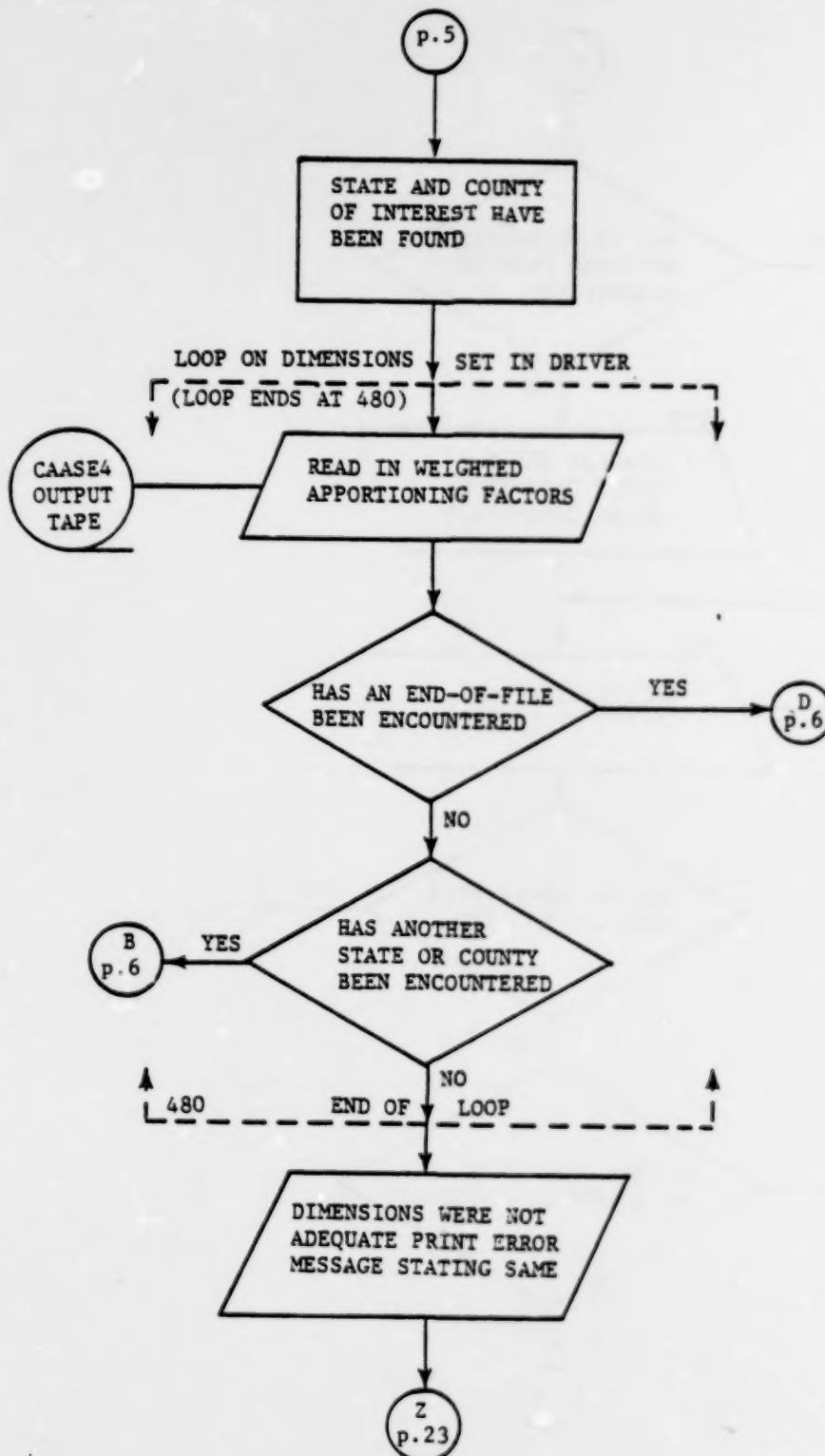


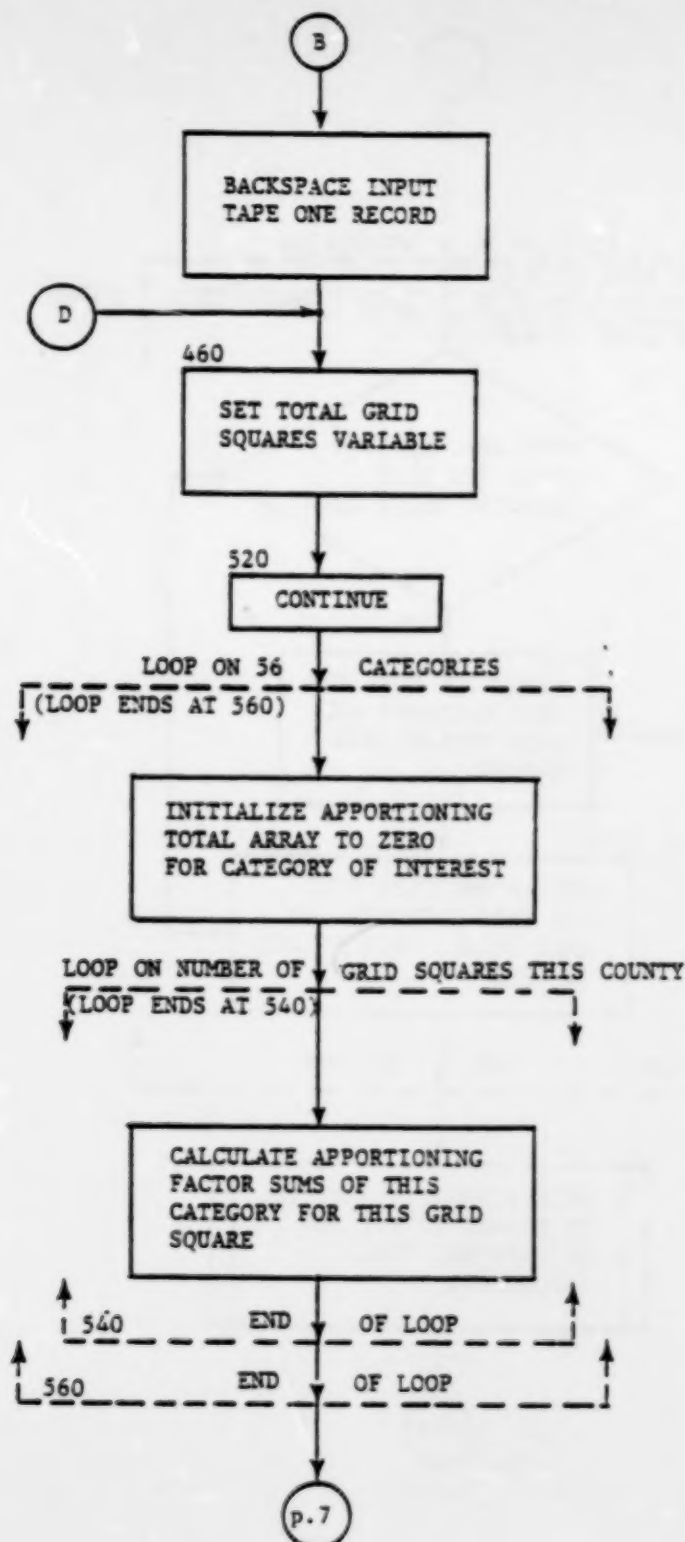


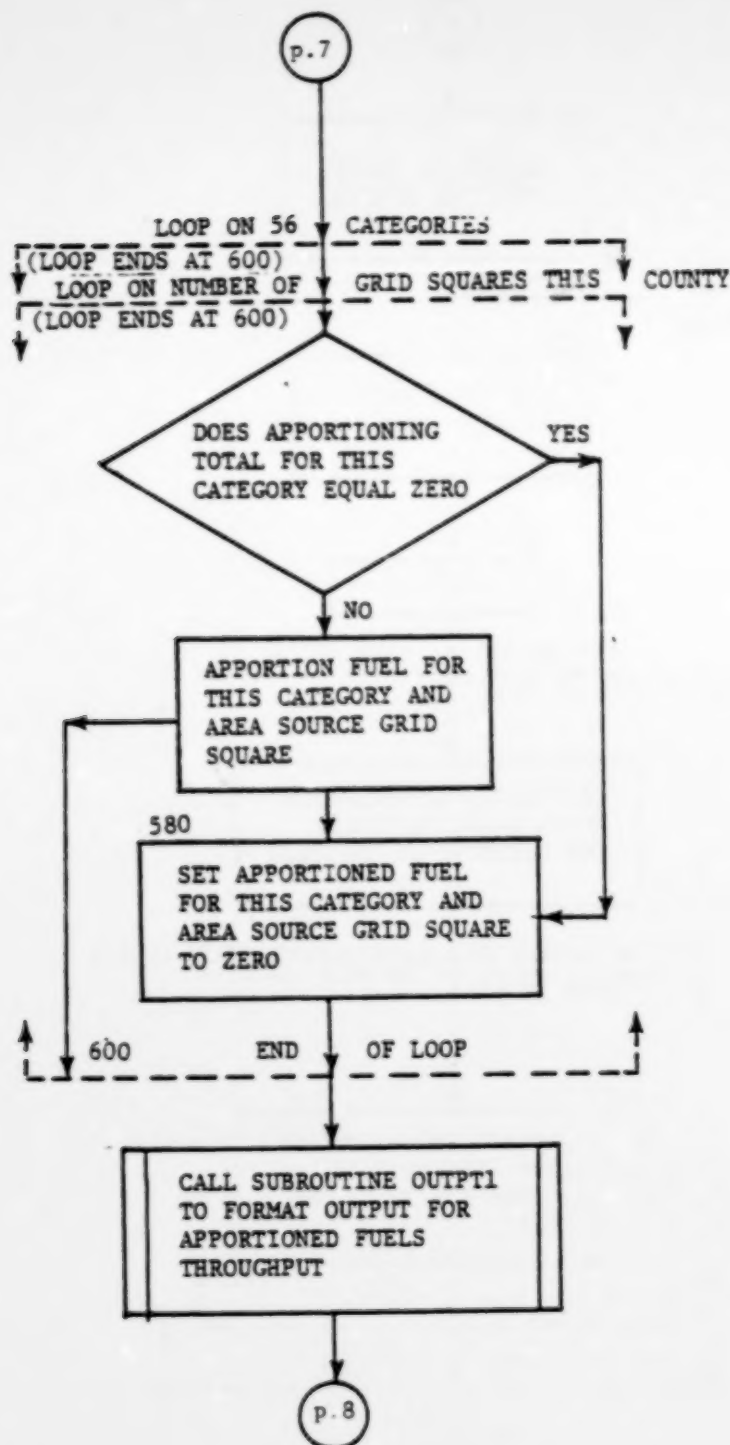


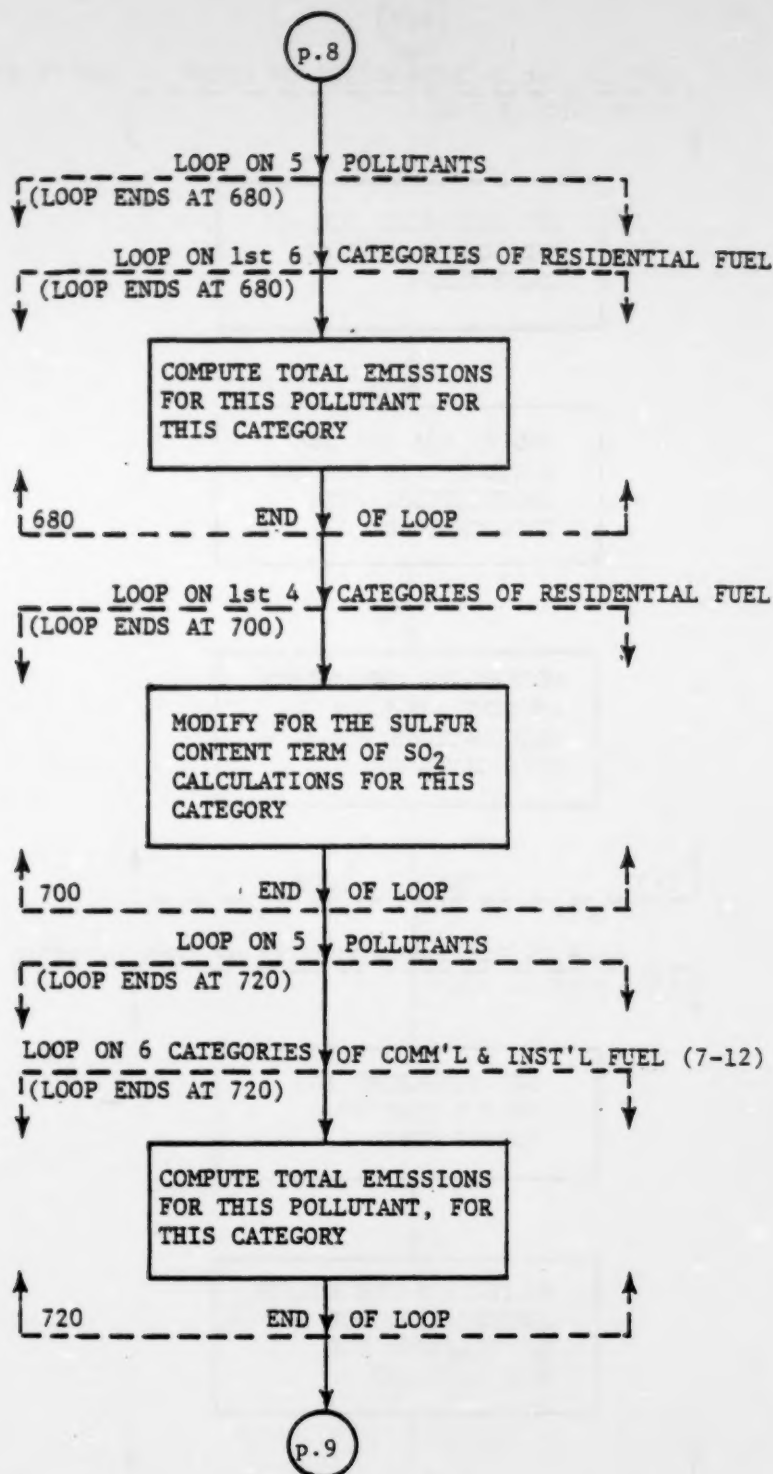


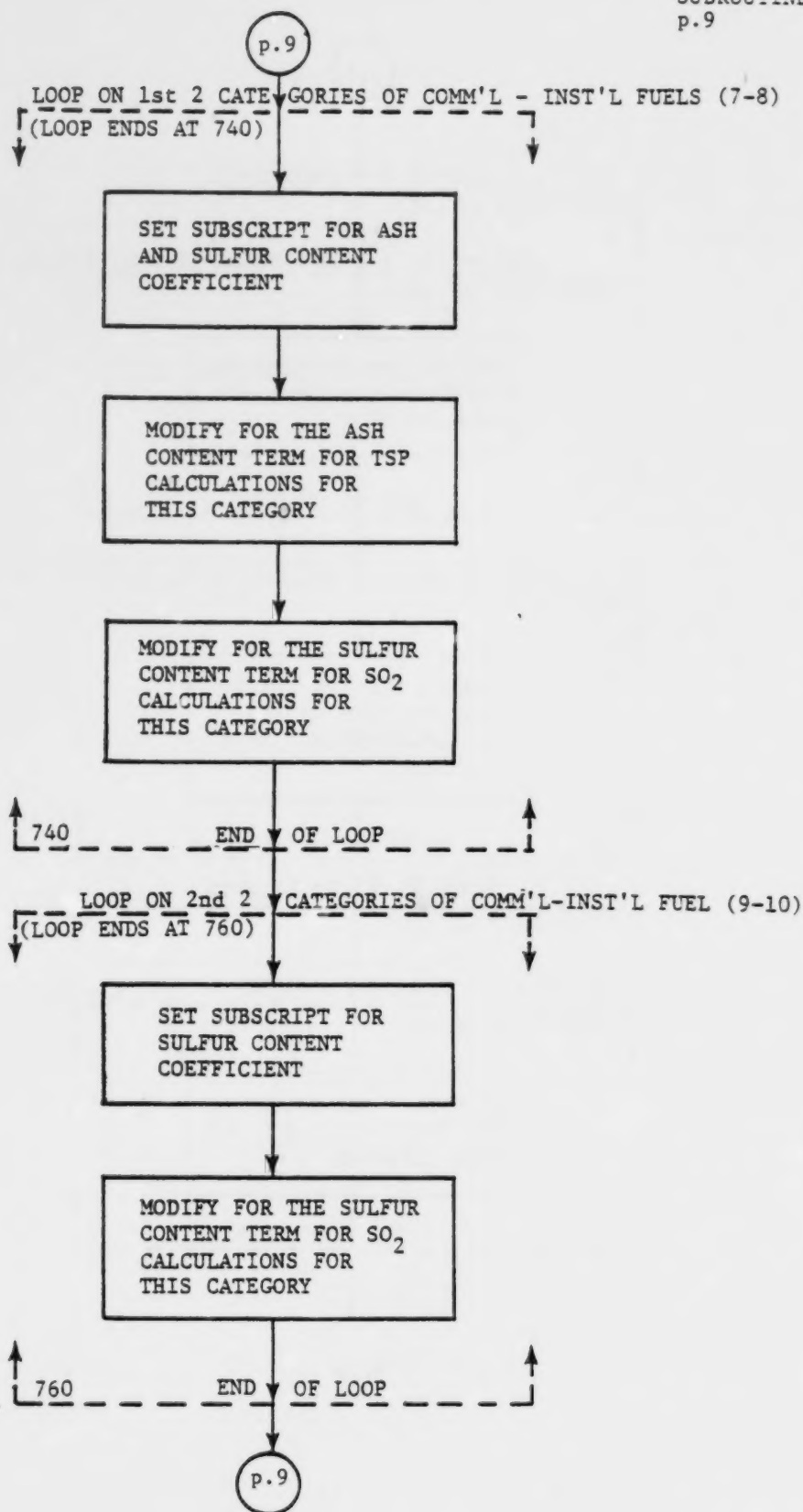


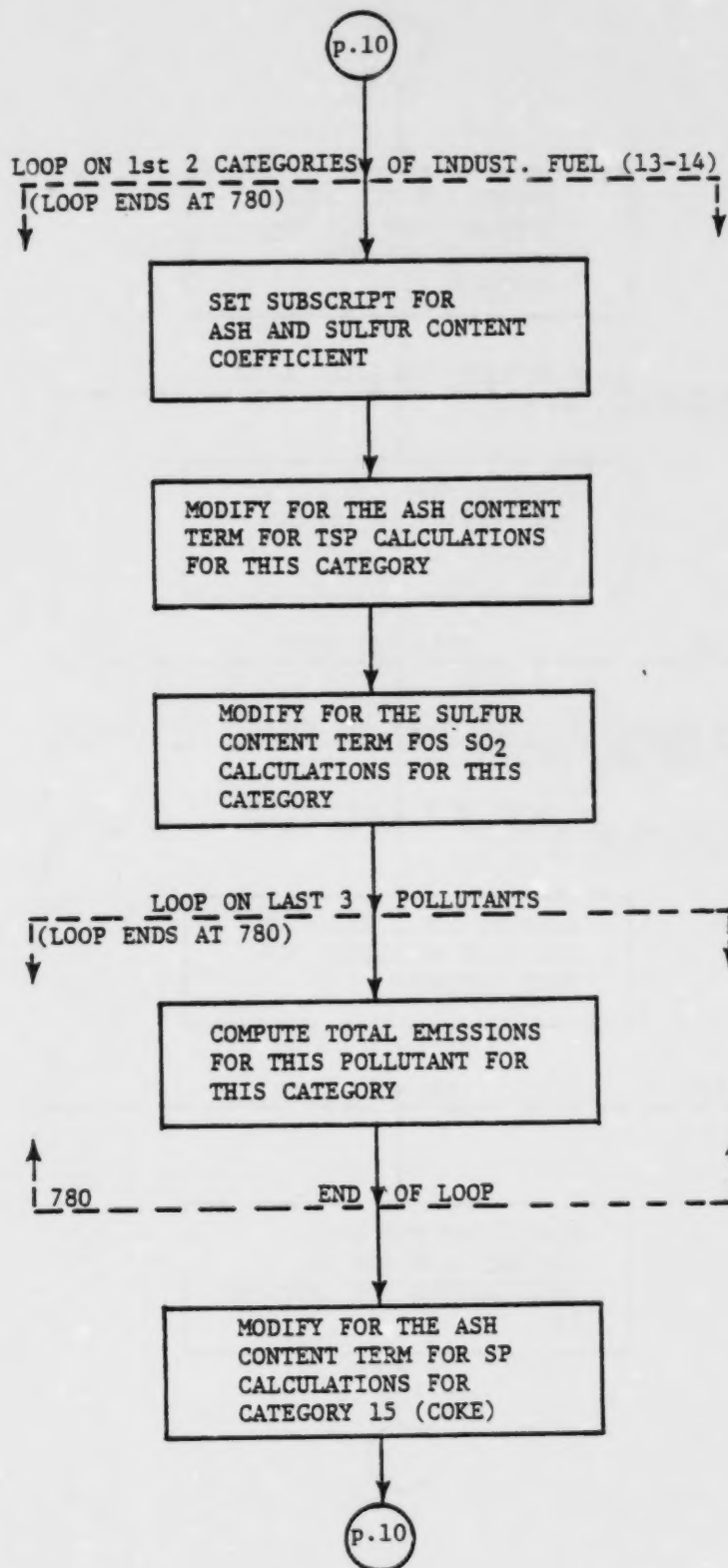


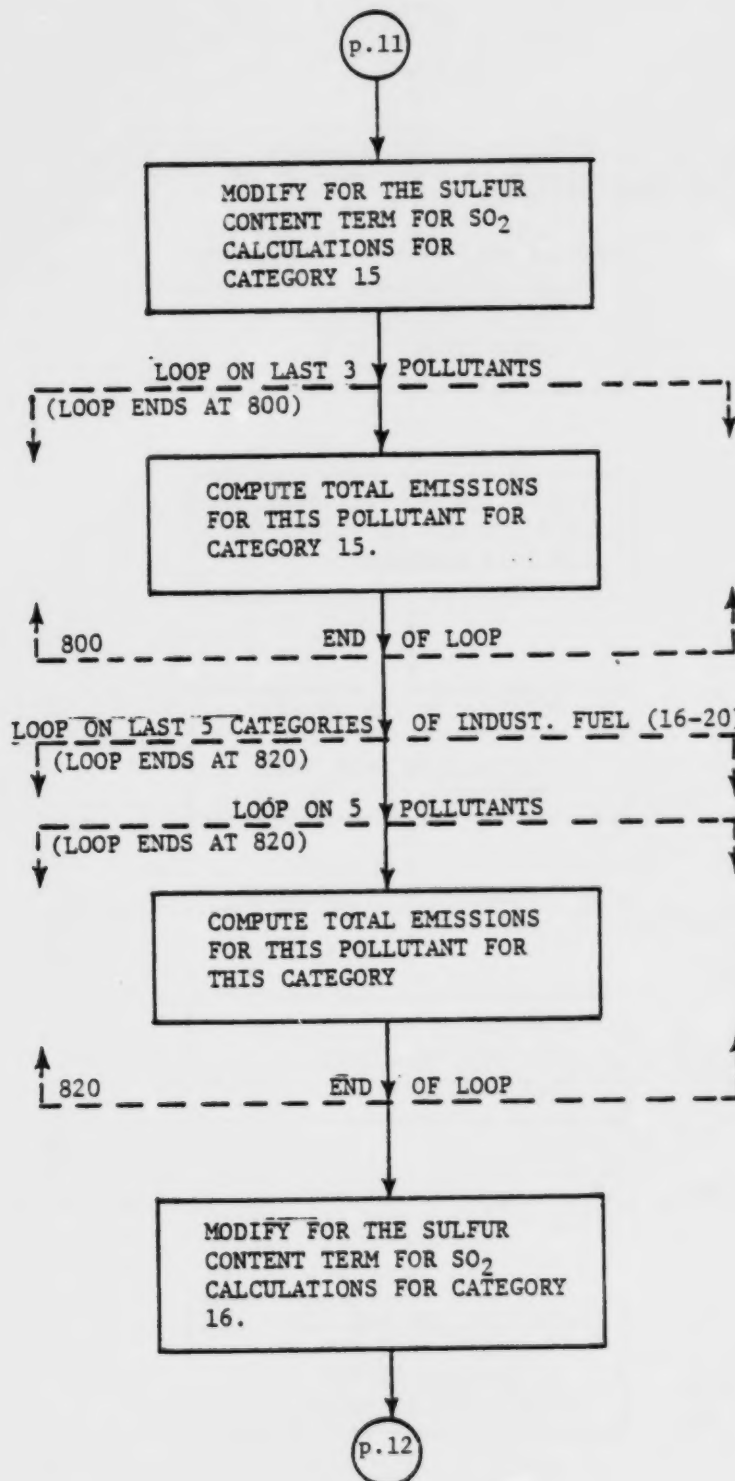


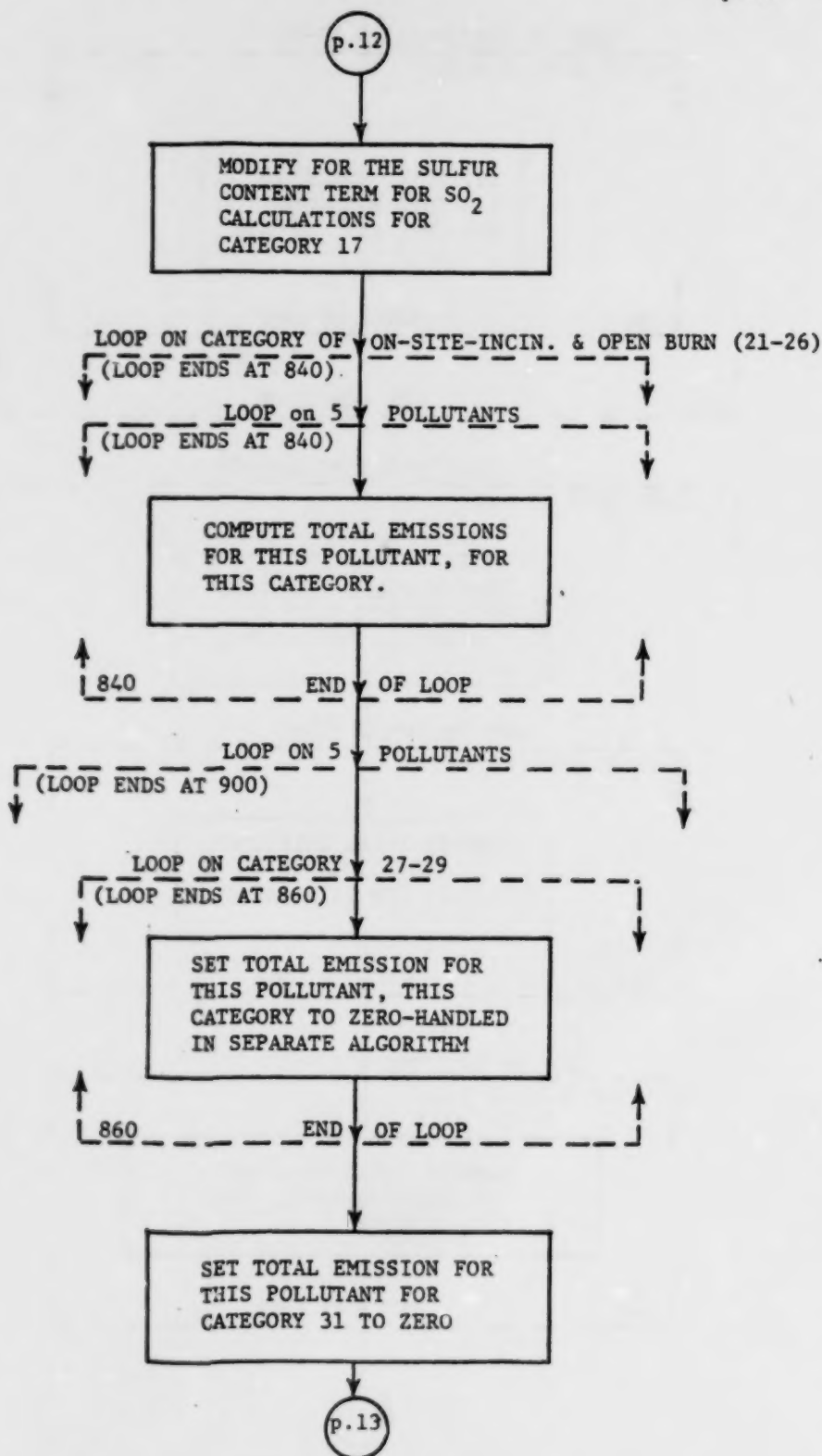


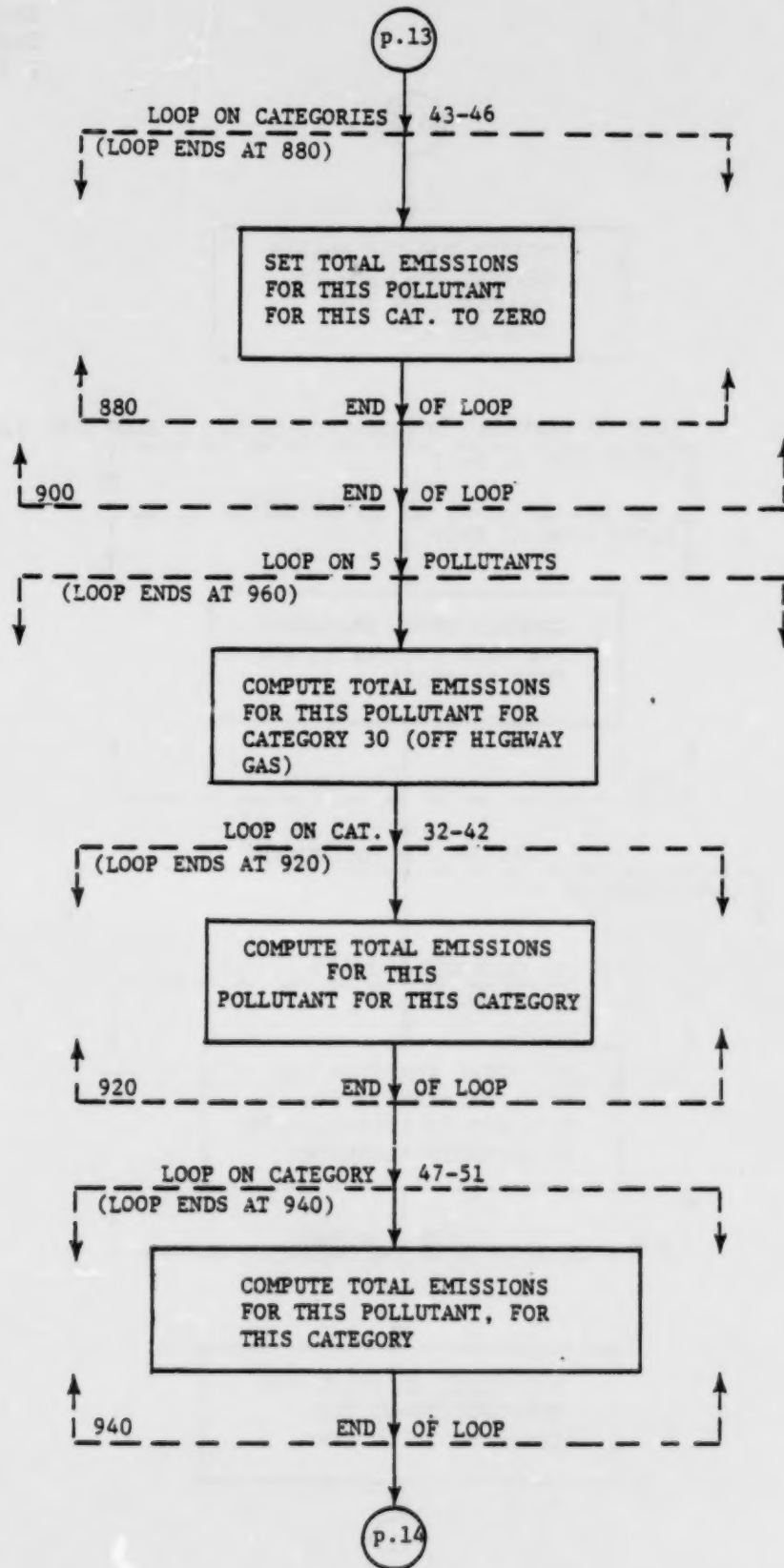


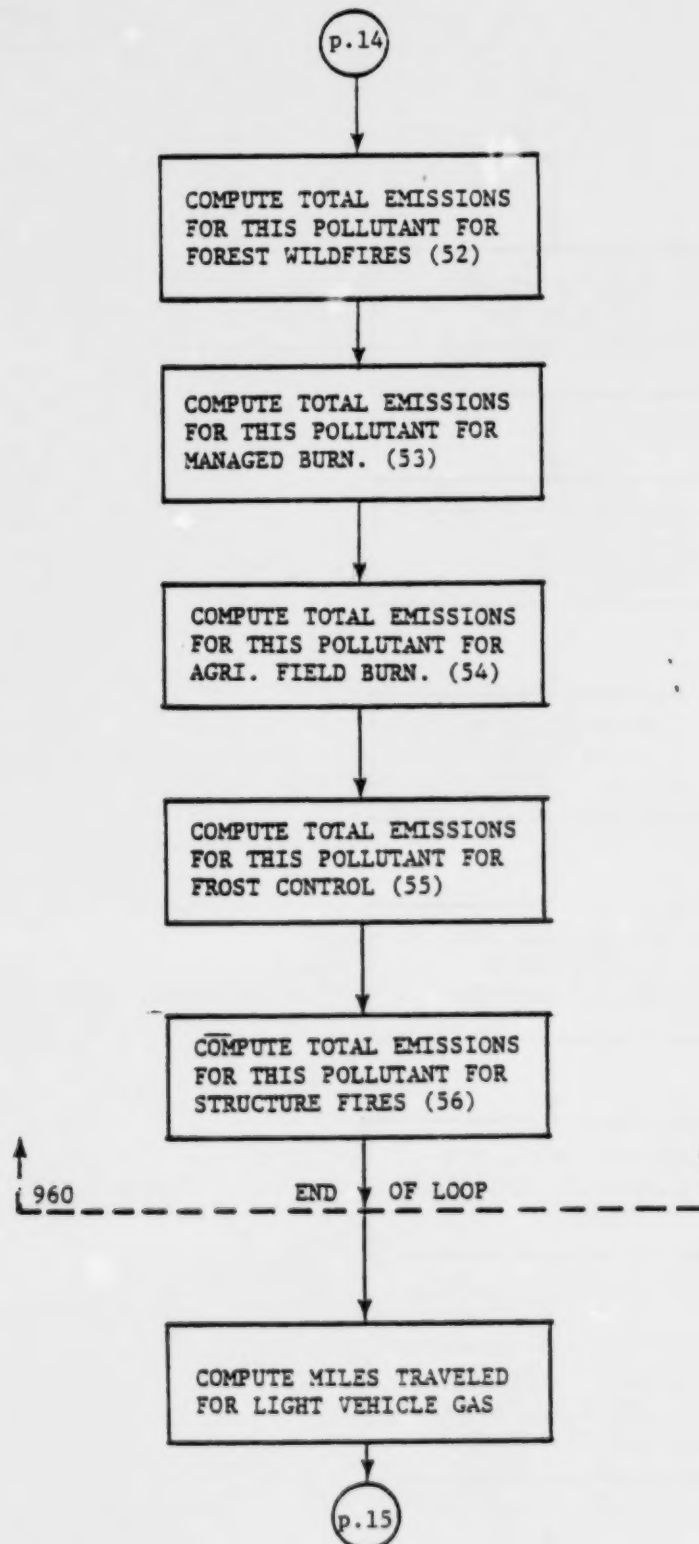


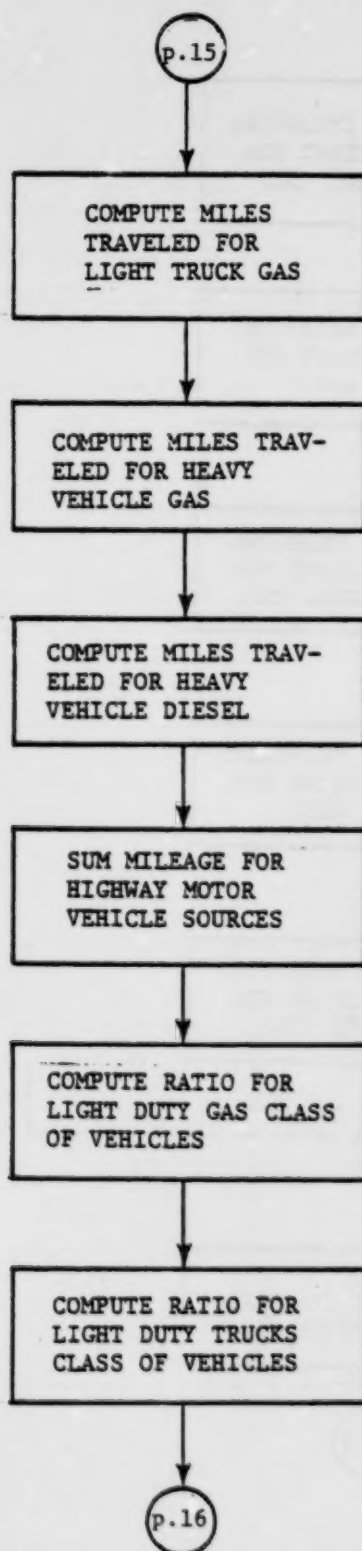


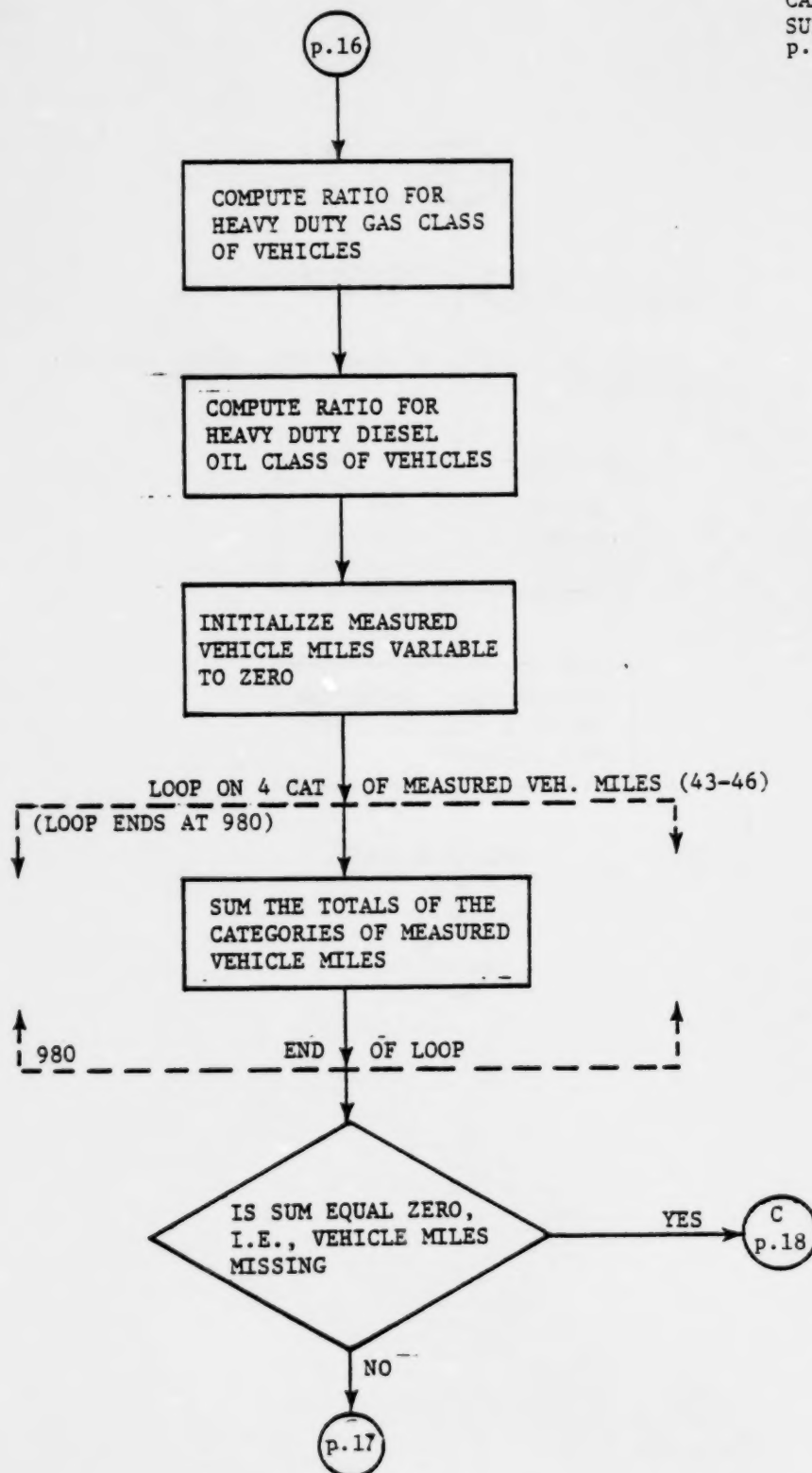


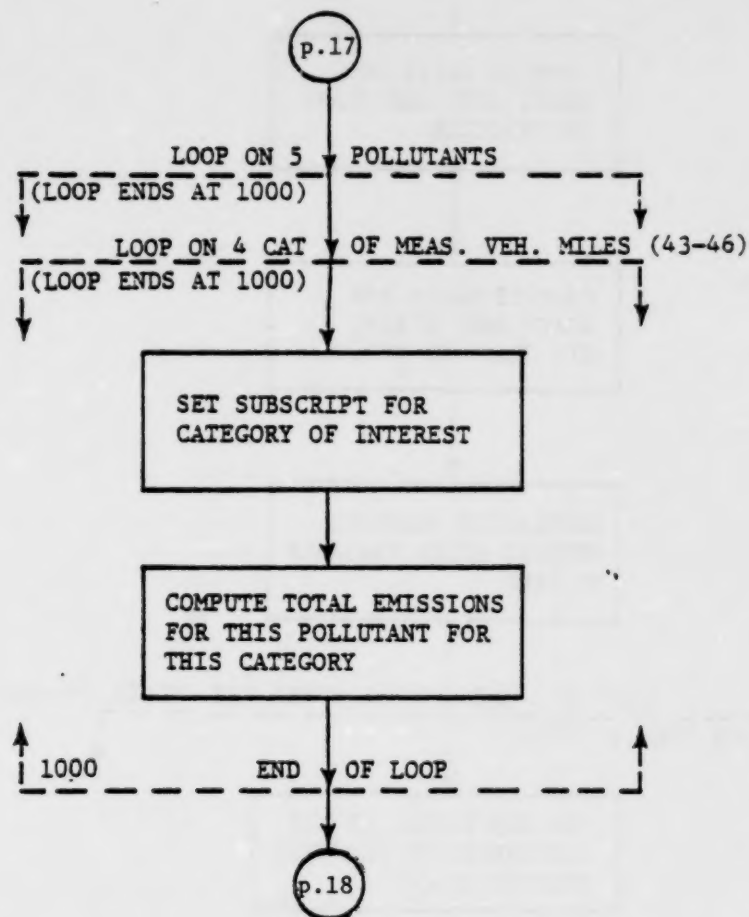


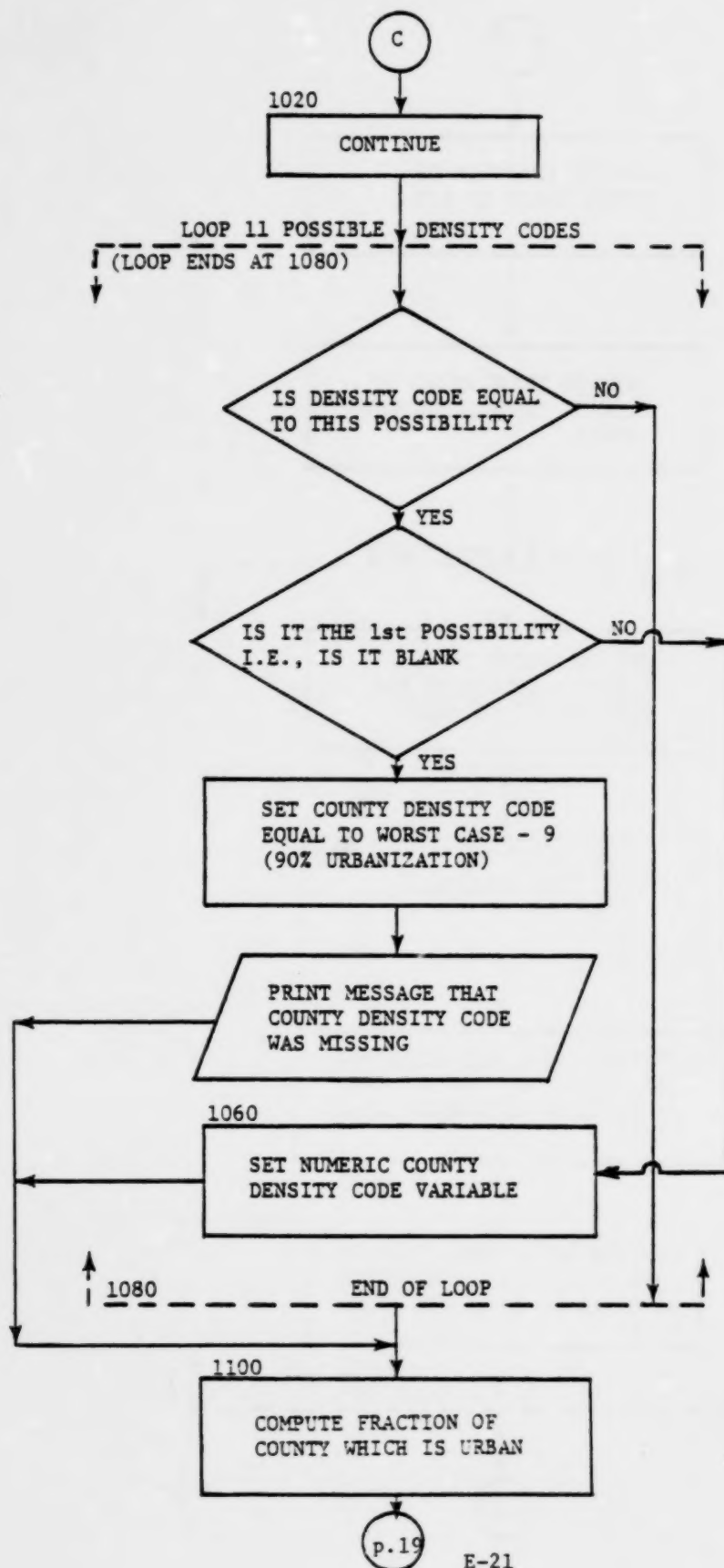


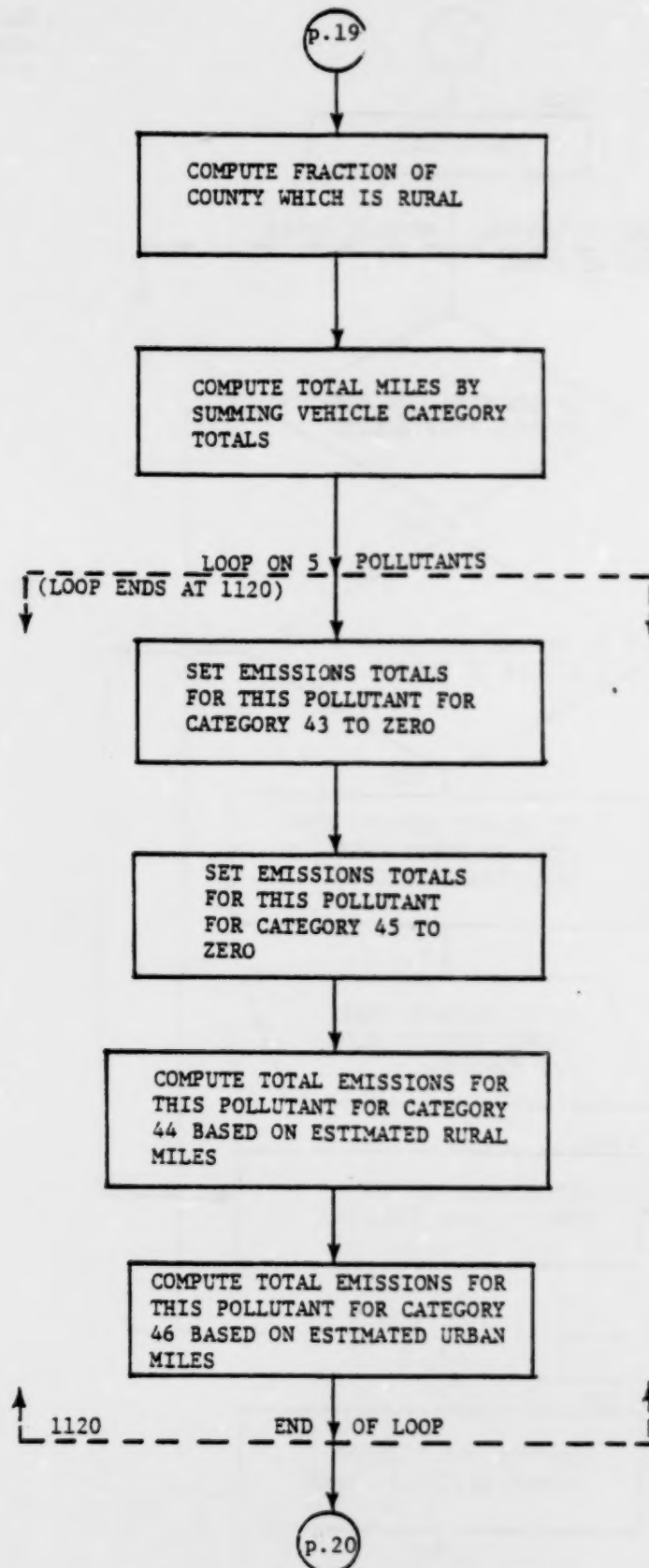


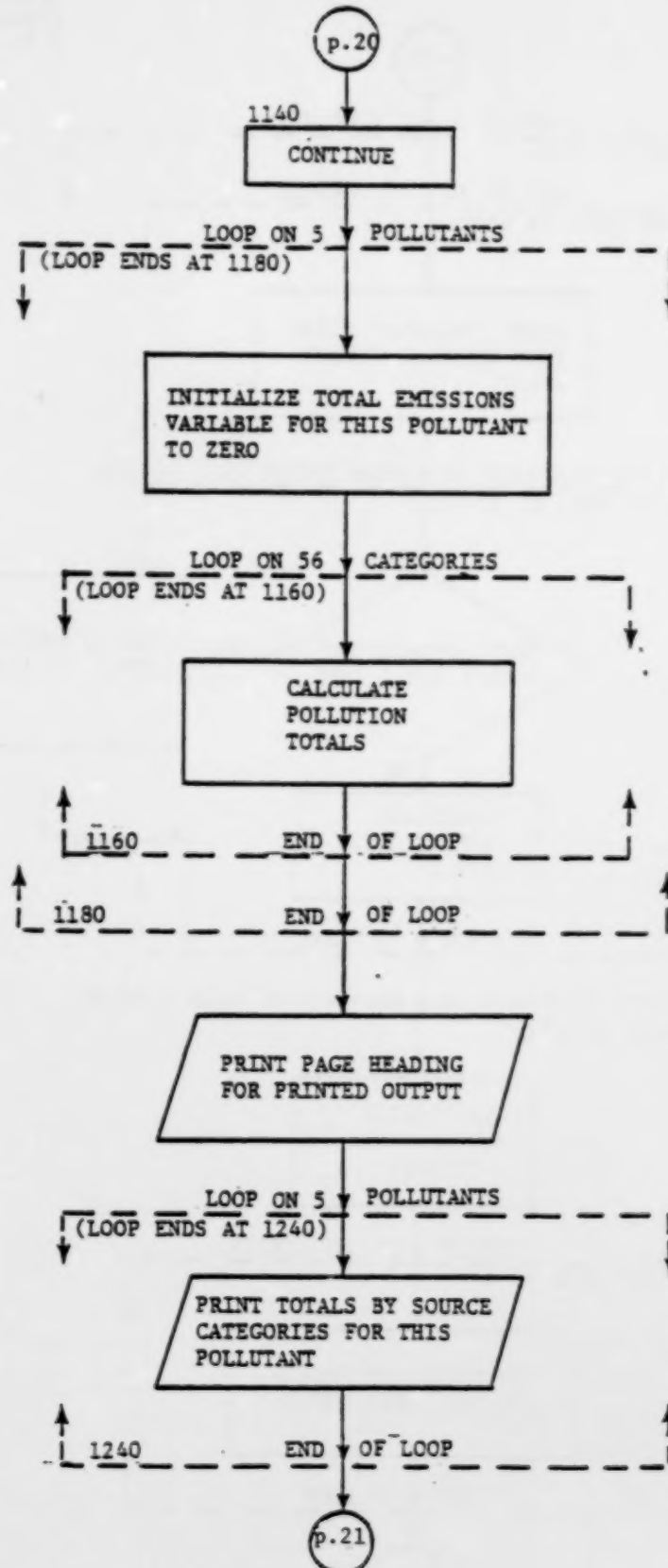


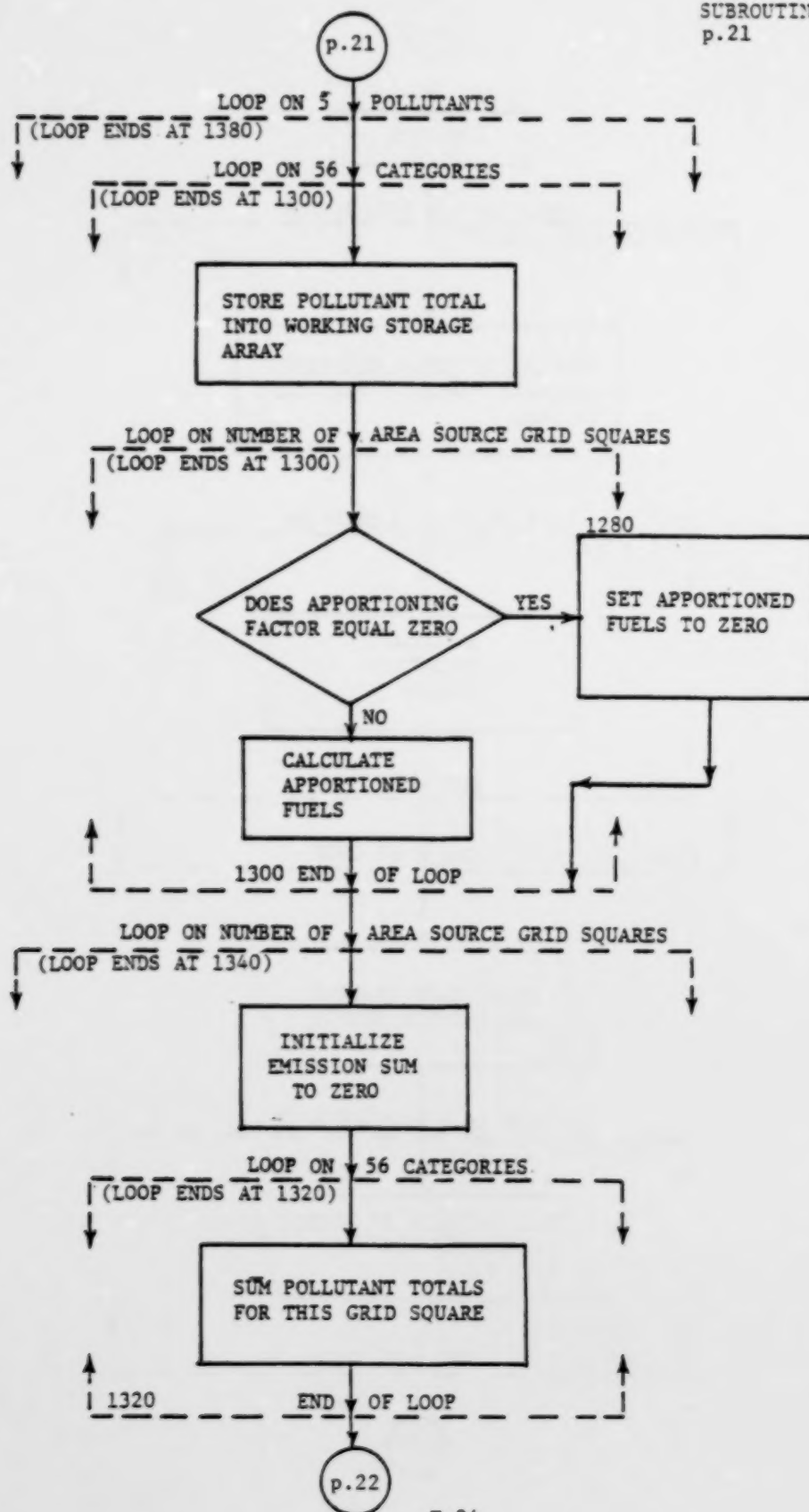


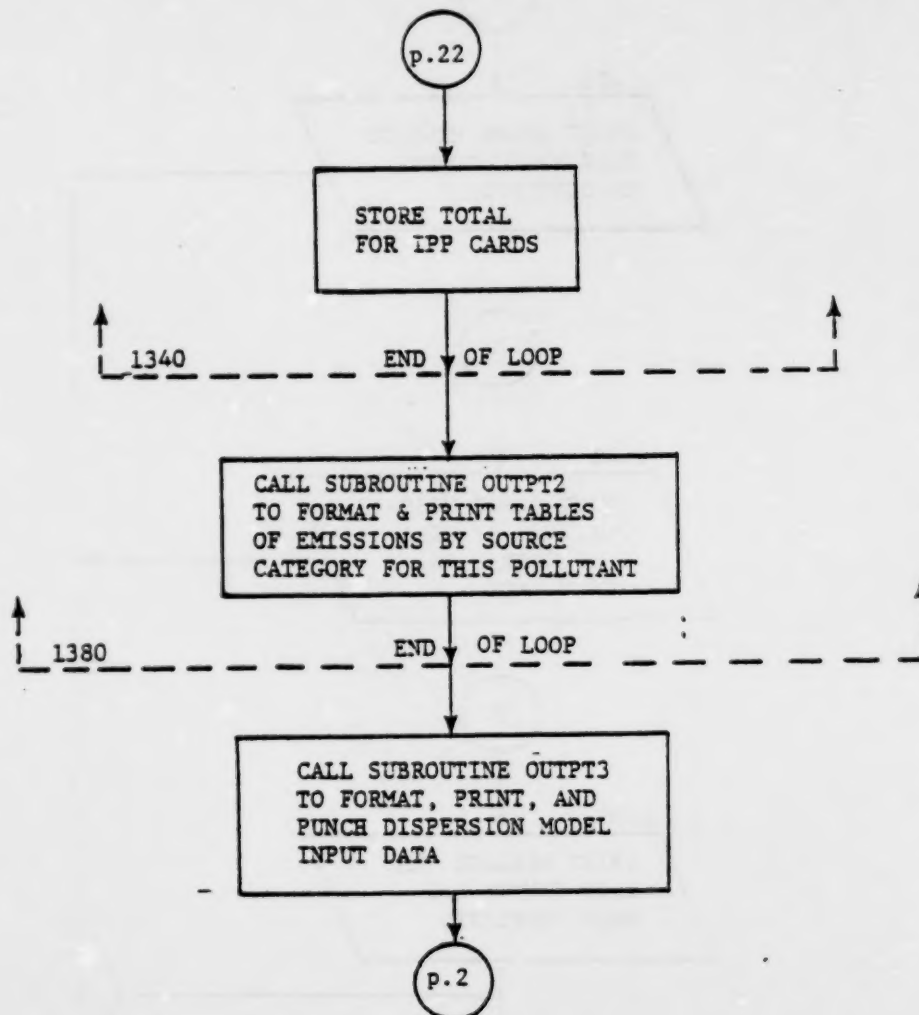


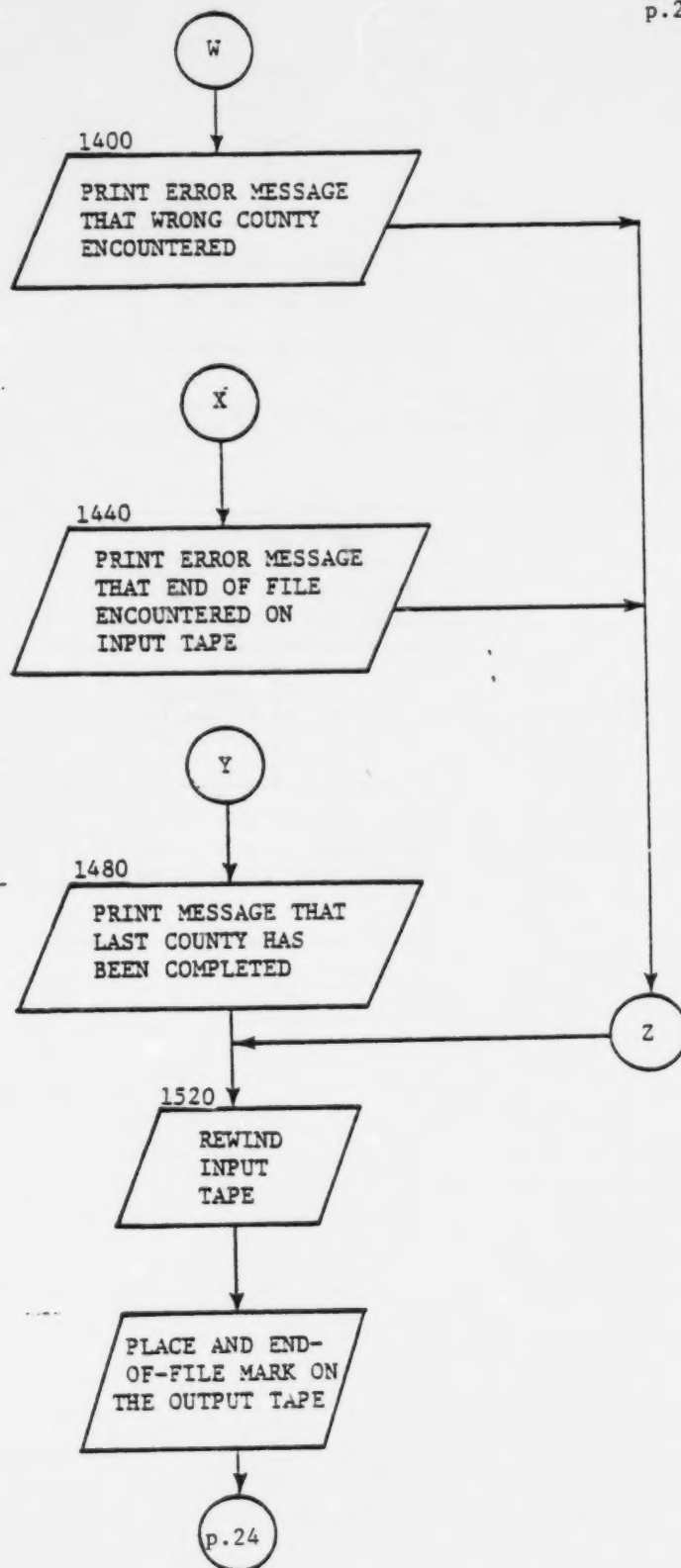


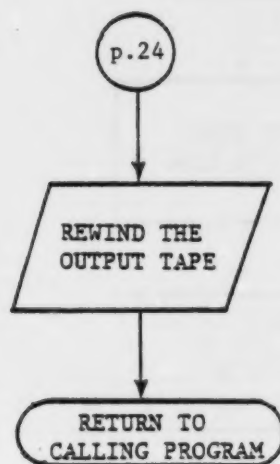


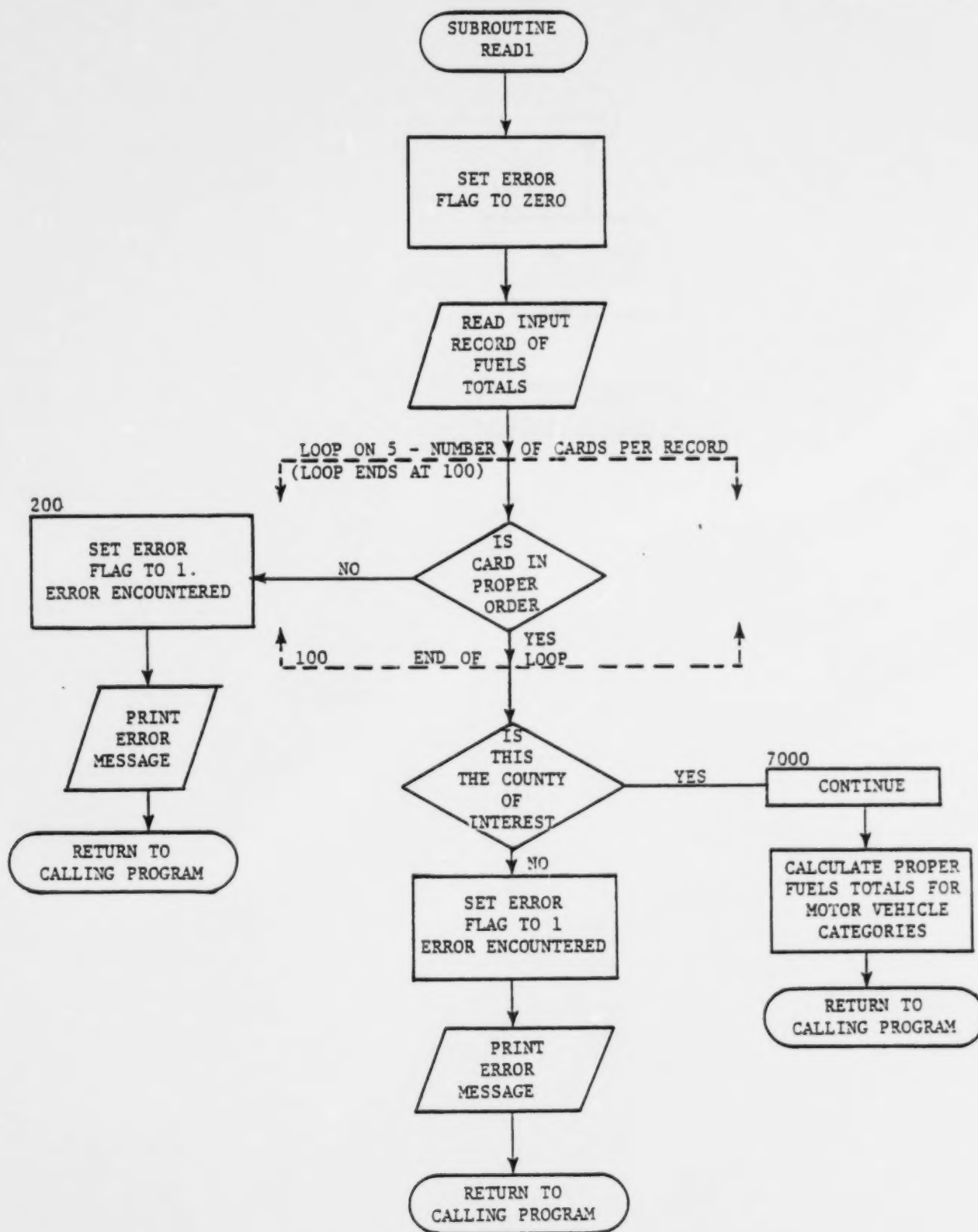


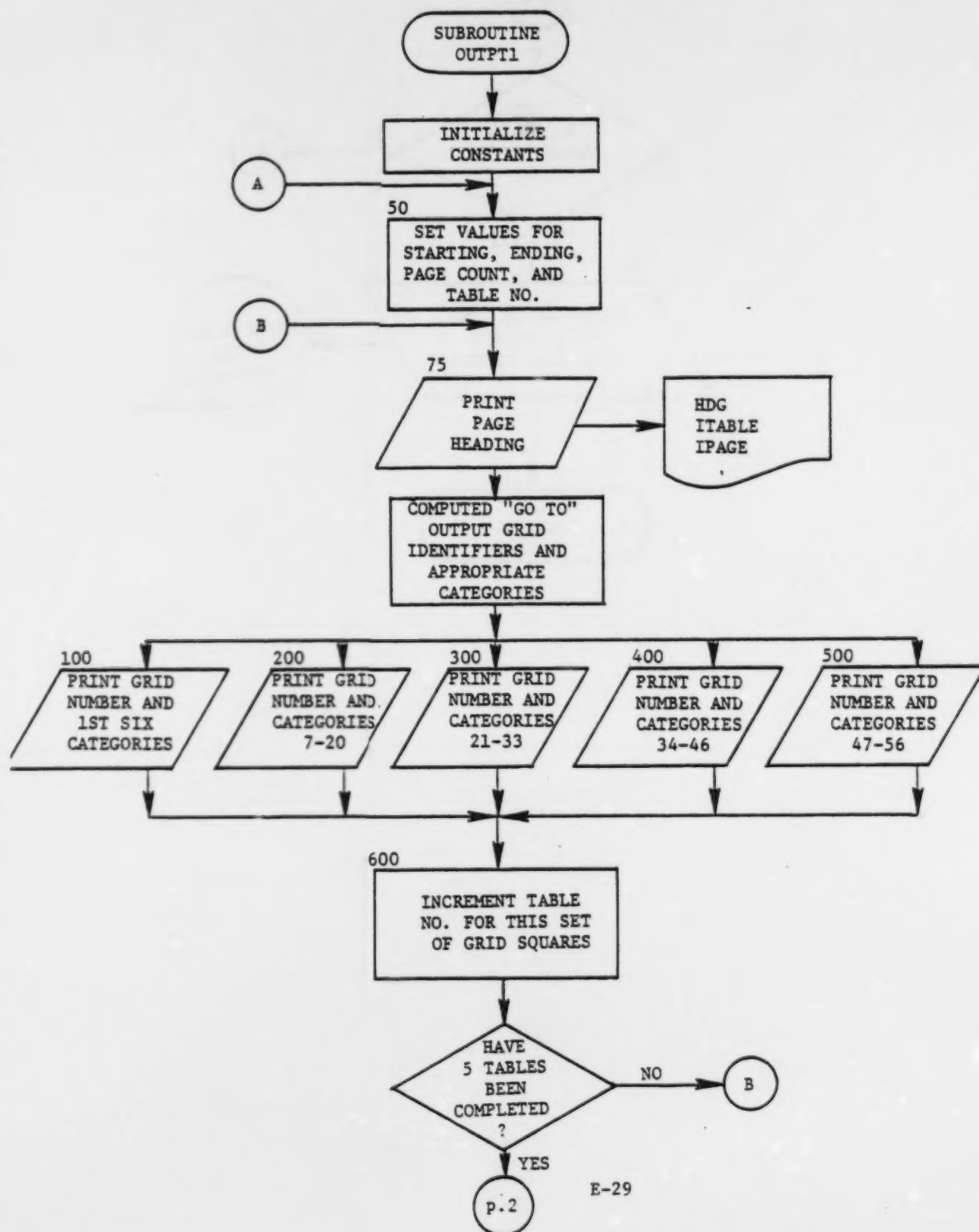


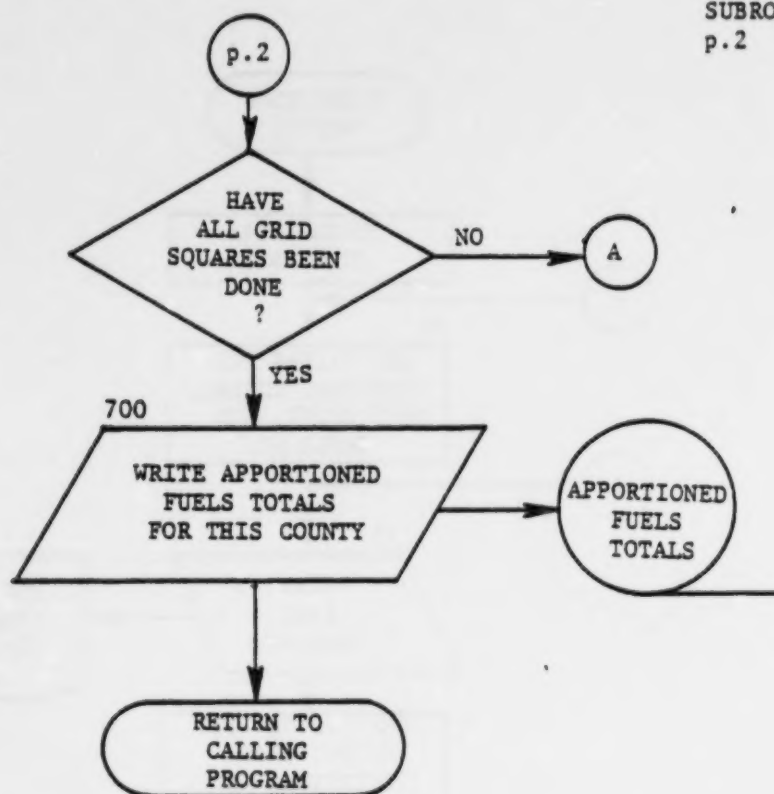


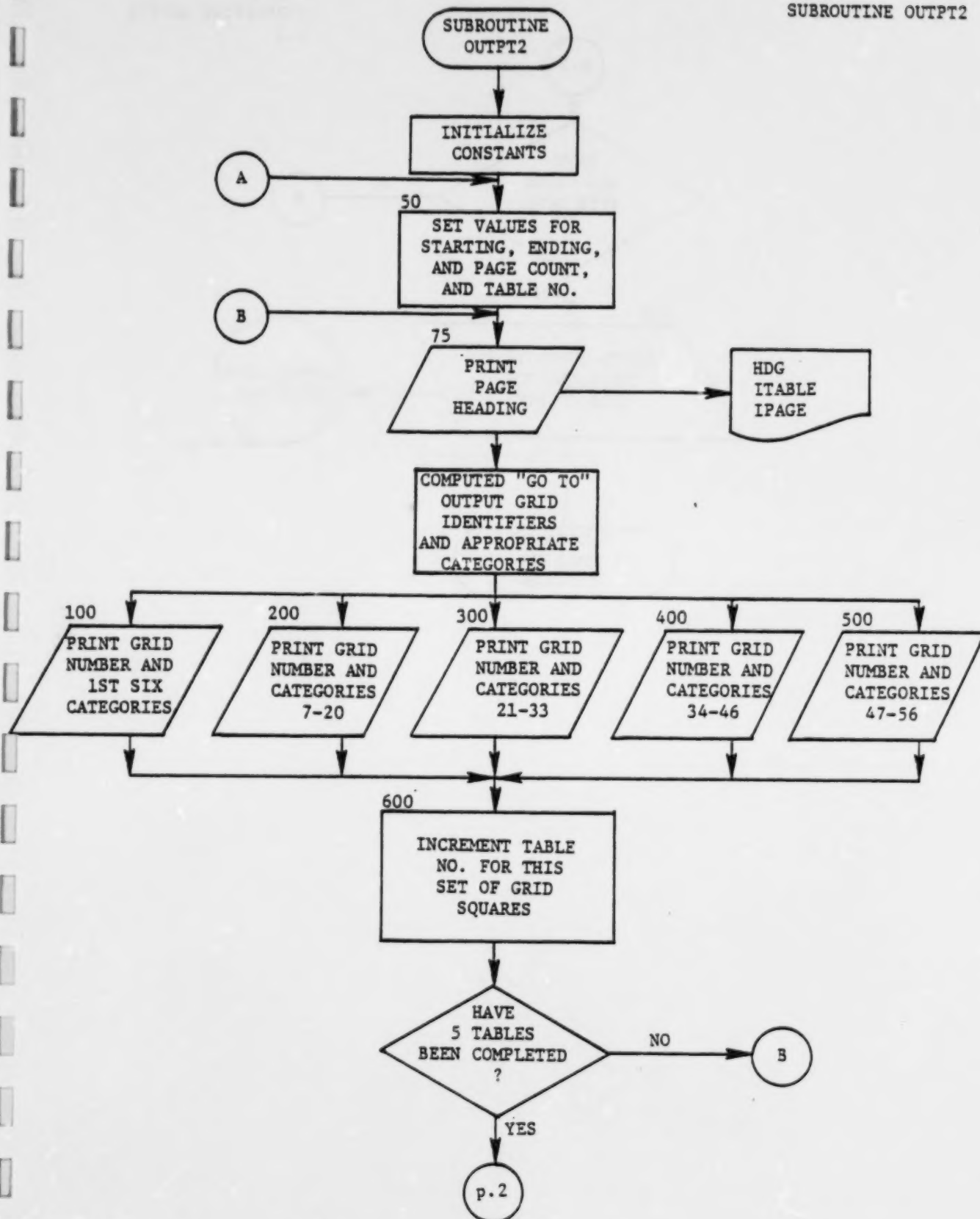


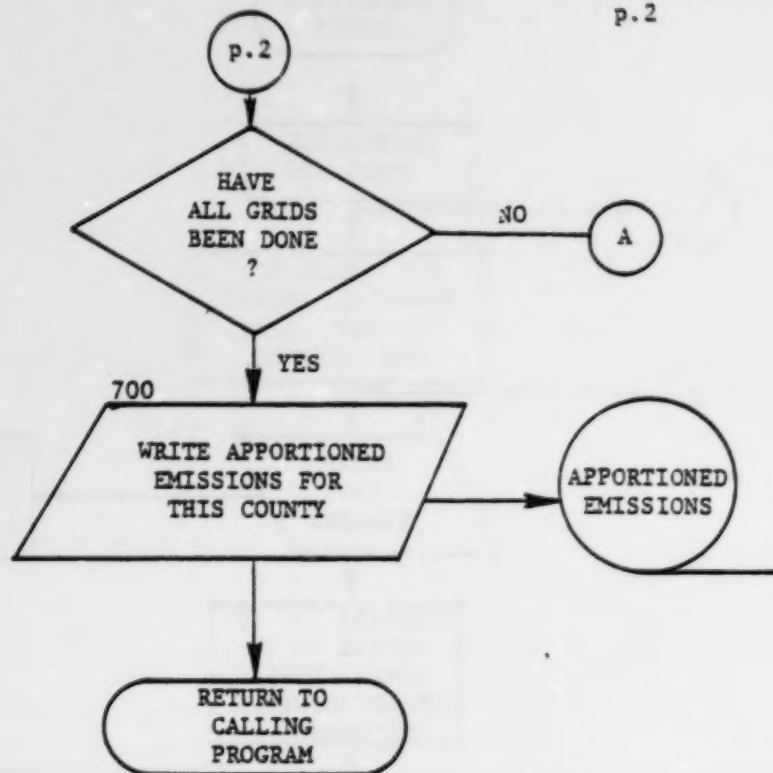


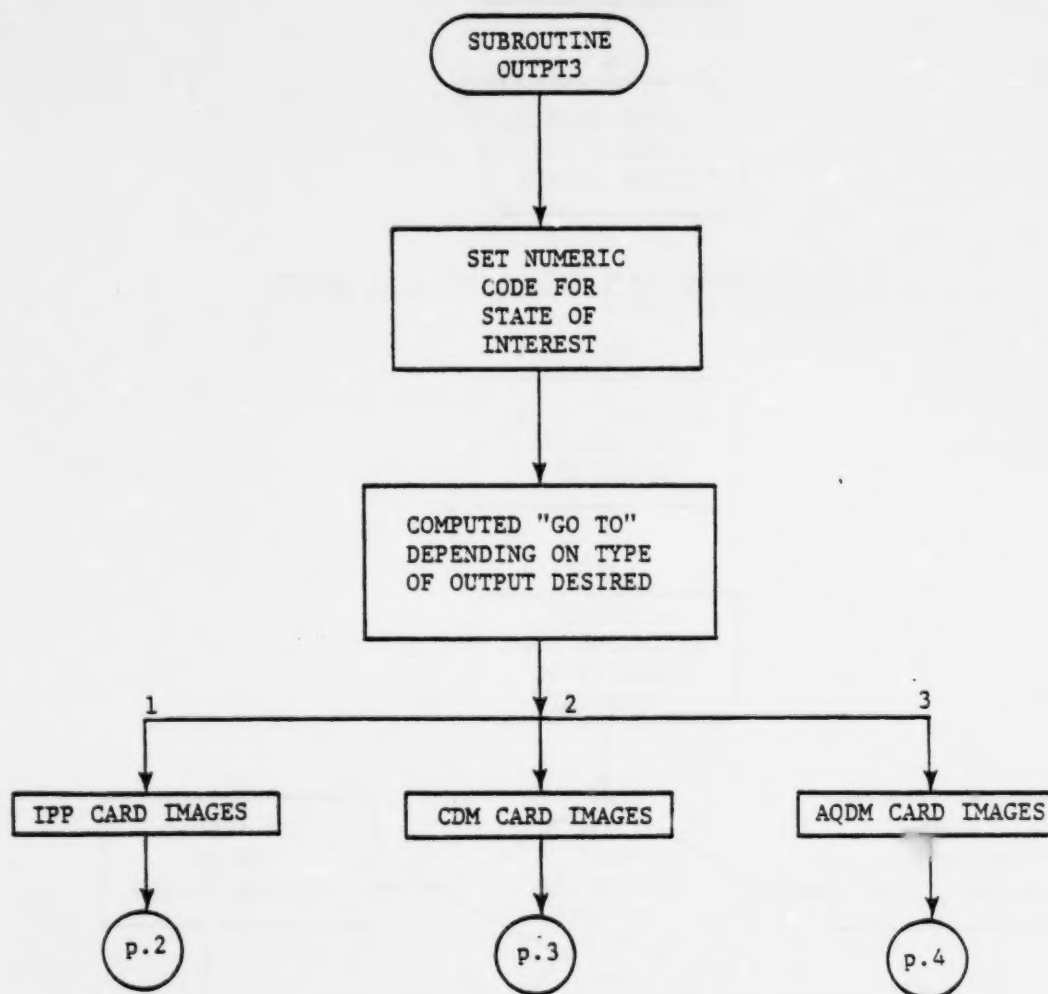


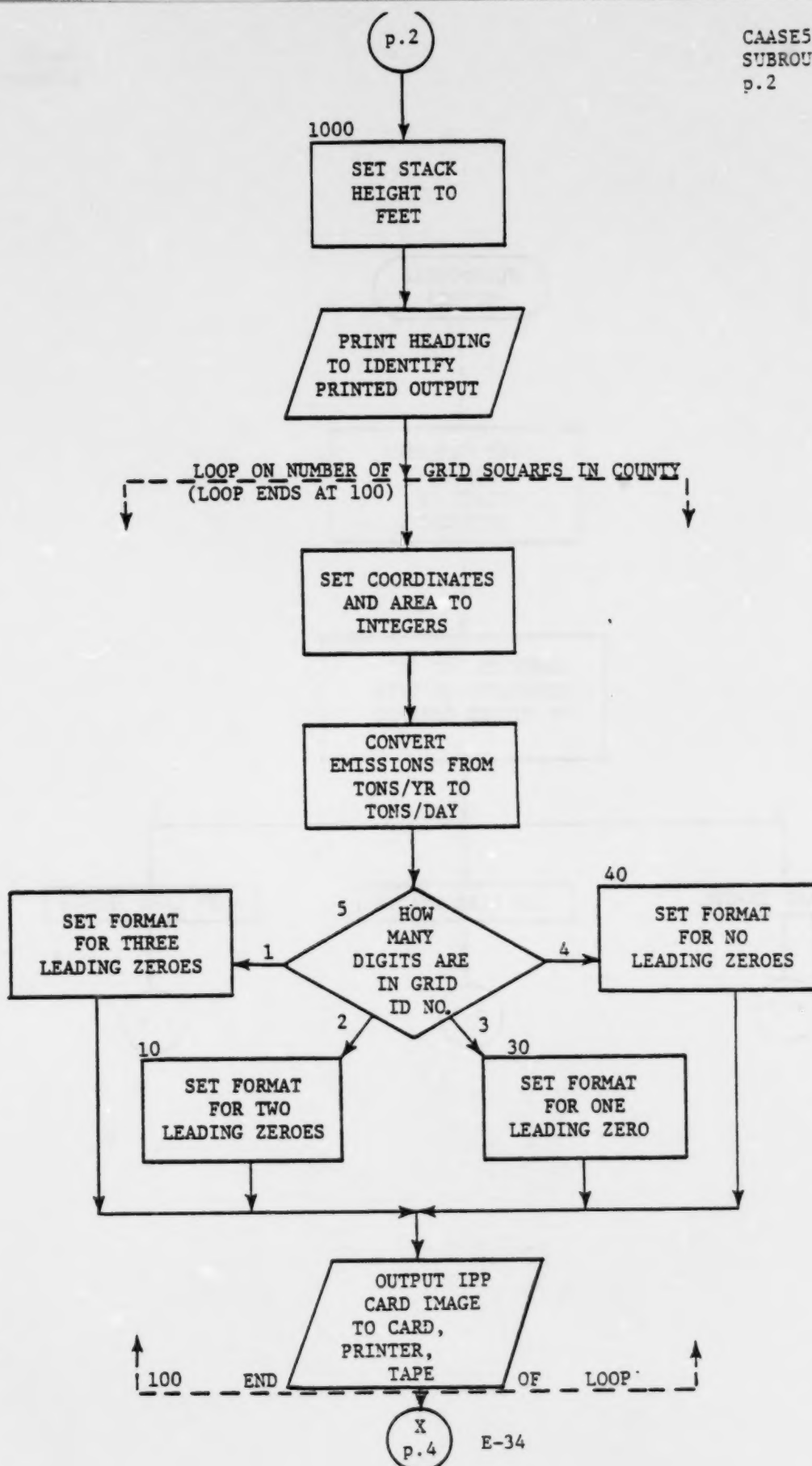


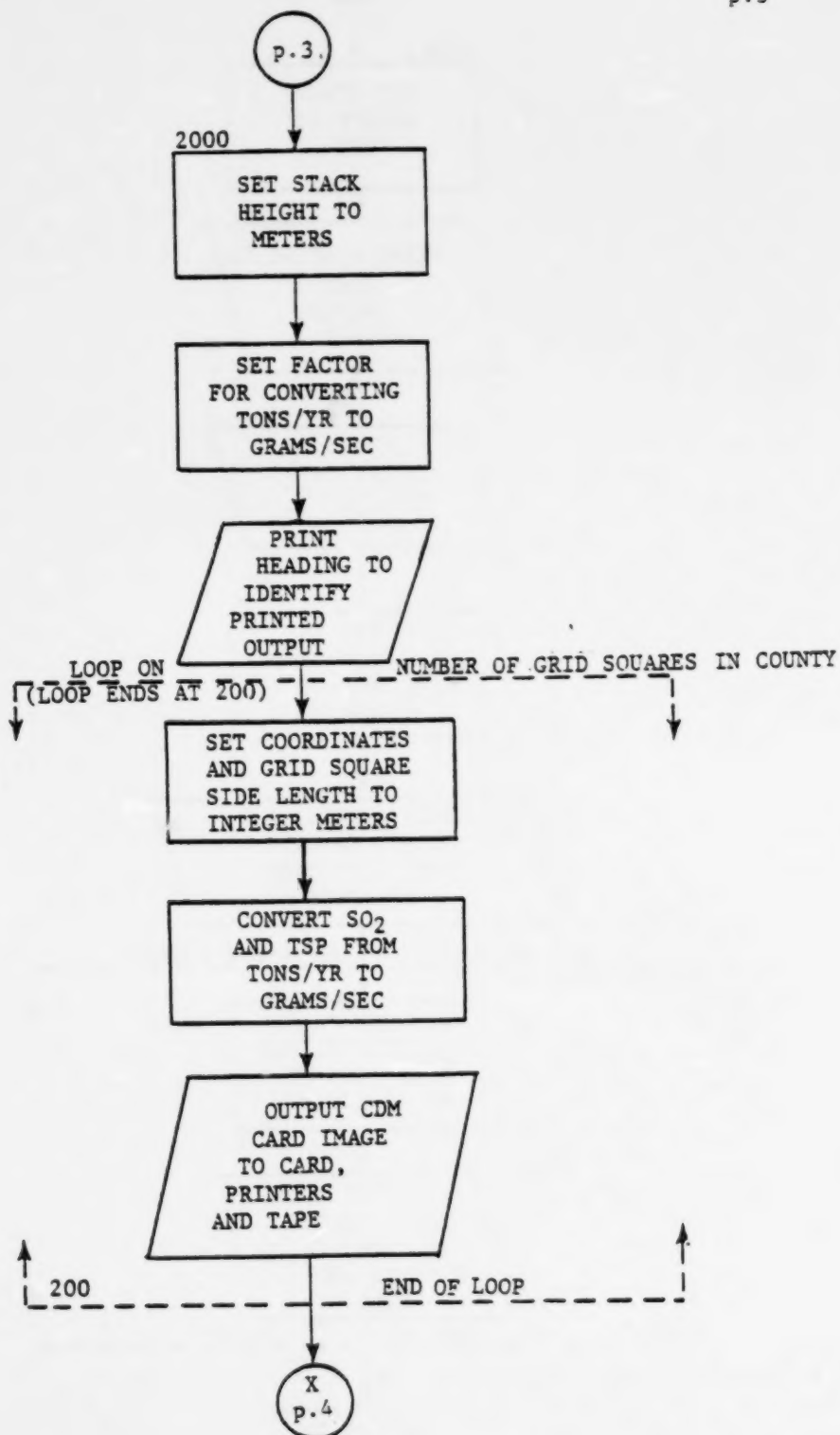


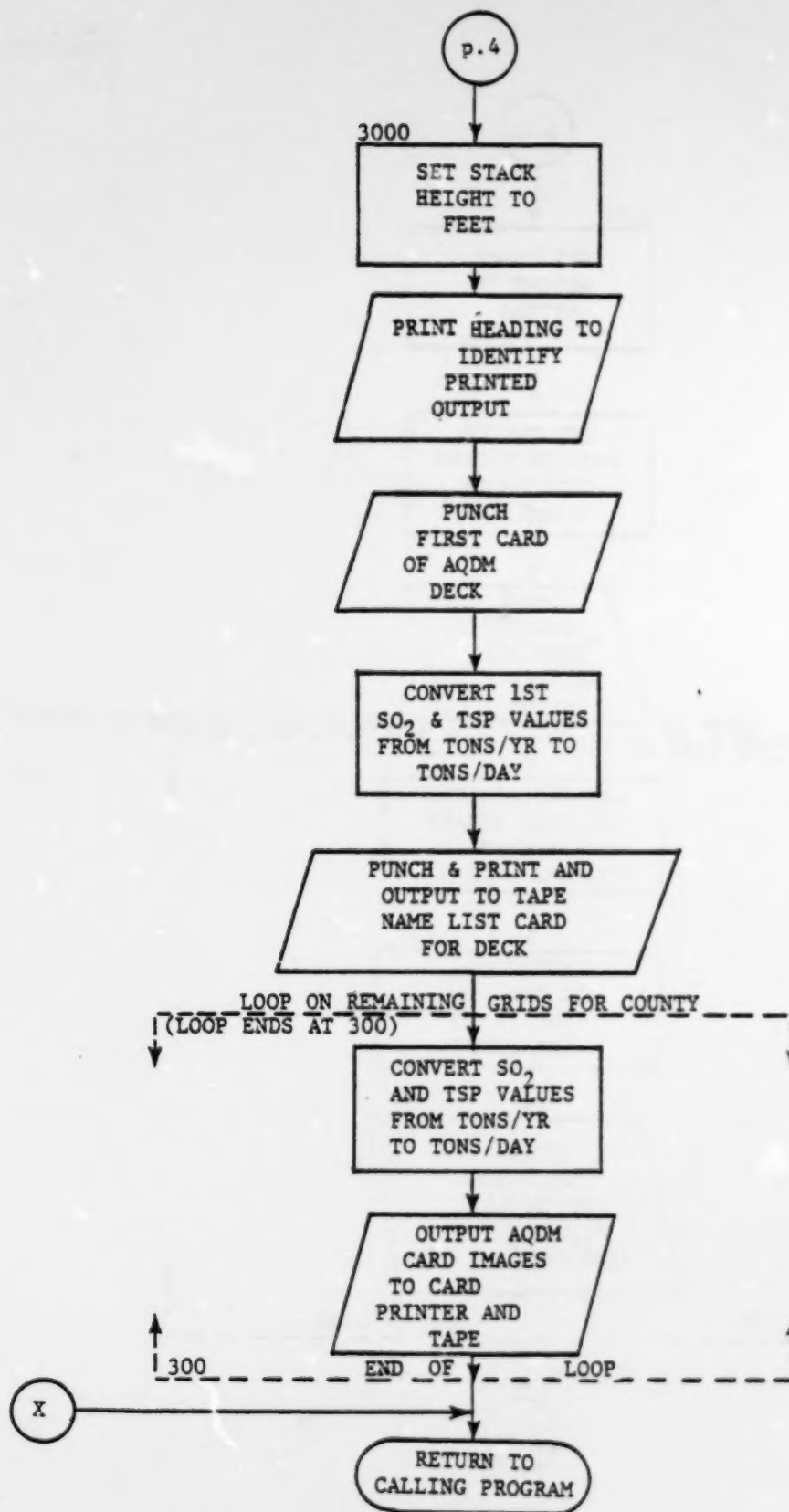












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C***PROGRAM NAME: CAASES
C
C DRIVER FOR CAASES TO SET DIMENSIONS
C MUST BE RECOMPILED ANYTIME IT IS NECESSARY TO CHANGE THE DIMENSIONS
C
C DIMENSION APPORT(56,217),OUTIPP(217,5),ID(217),X(217),Y(217),
C IAREA(217),APFULL(56,217)
C
C NDIM IS THE NUMBER OF GRID SQUARES (MINUS ONE) IN A COUNTY-- IT
C SHOULD BE SET DEPENDENT ON THE HIGHEST NUMBER IN THE COUNTIES BEING
C PROCESSED DURING A COMPUTER RUN.
C
NDIM=216
CALL CAASES (APPORT,OUTIPP,APFUEL,ID,X,Y,AREA,NDIM)
CALL EXIT
END
00000100
00000200
00000300
00000400
00000500
00000600
00000700
00000800
00000900
00001000
00001100
00001200
00001300
00001400
00001500
00001600

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SUBROUTINE CAASE5(APPORT,OUTIPP,APFUEL,ID,X,Y,AREA,NDIM)
00000100
00000200
00000300
00000400
00000500
00000600
00000700
00000800
00000900
00001000
00001100
00001200
00001300
00001400
00001500
00001600
00001700
00001800
00001900
00002000
00002100
00002200
00002300
00002400
00002500
00002600
00002700
00002800
00002900
00003000
00003100
00003200
00003300
00003400
00003500
00003600
00003700

C**CAASE5 USES THE APPORTIONING FACTORS DEVELOPED BY CAASE4 FOR THE
C GRID SQUARES DEVELOPED IN CAASE2 AND THE FUELS/THROUGHPUT FOR EACH
C AREA SOURCE INPUT FORM (EPA(DUR)219) FOR EACH COUNTY IN THE STUDY
C AREA. EMISSION FACTORS FOR EACH SOURCE CATEGORY ARE READ FOR EACH OF
C THE PRIMARY POLLUTANTS (TSP,S02,NOX,HC,CO). FUELS/THROUGHPUT ARE
C APPORTIONED TO EACH GRID SQUARE FOR EACH SOURCE CATEGORY. APPLYING
C EMISSION FACTORS, EMISSIONS ARE CALCULATED FOR EACH SOURCE CATEGORY
C POLLUTANT AND THEN APPORTIONED TO EACH GRID SQUARE ON A COUNTY BY
C COUNTY BASIS. TABLES ARE PRINTED AND THE USER HAS THE OPTION OF
C PRODUCING AREA SOURCE FORMATTED INPUT CARDS FOR ANY ONE OF THE THREE
C DISPERSION MODELS--AQM, IPP, OR COM. EMISSION FACTORS ARE READ IN
C FOR EACH POLLUTANT/SOURCE CATEGORY COMBINATION. EXCEPT IN THE CASE
C OF HIGHWAY MOTOR VEHICLE SOURCE EMISSION FACTORS, THE FACTORS ARE
C SCALED AND UNITS ARE CONVERTED OFF-LINE, I.E. IF THE EMISSION FACTOR
C FOR EXAMPLE, IS 20 POUNDS OF TSP PRODUCED FOR EACH TON OF BITUMINOUS
C COAL BURNED FOR HOME HEATING AND THE TOTAL TONS BURNED IS EXPRESSED
C IN TENS OF TONS ON THE WEDS AREA SOURCE FORM, THEN THE FACTOR READ
C IN IS 0.10 (10 SCALING TIMES 20 LBS PER TON BURNED DIVIDED BY 2000
C LBS PER TON) AND THE PROGRAM MULTIPLIES THE FUEL REPORTED ON THE FORM
C BY THE 0.10 FACTOR YIELDING EMISSIONS IN TONS. FOR THOSE SOURCE
C CATEGORY/POLLUTANT COMBINATIONS WHERE PERCENT ASH OR SULFUR CONTENT
C IS USED, THE PROGRAM AUTOMATICALLY APPLIES THEM DURING THE ON-LINE
C**CALCULATION.
C
C*** DATA STATEMENT FOR LABELS FOR EACH POLLUTANT TABLE IS INCLUDED IN
C OUTPUT ROUTINE
C DIMENSIONS ASSUME NDIM IS MAX NUMBER OF GRIDS PER COUNTY
C
C DIMENSION FUEL(11)
C REAL*8 RLD,RLDI,RHDD,VLGIG,ILGIG,VHVG,VHVD,SUM4,TOT4I
C REAL*8 PU,PK
C DIMENSION APPORT(56,NDIM),APTOT(56),OUTIPP(NDIM,5),EFFACT(56,5),APFUEL(56,NDIM)
C
C APFUEL ARRAY CONTAINS APPORTIONED FUELS EARLY IN THE PROGRAM AND

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C
C      HEAD (IREADR,100) EMFACS
C
C      THE FOLLOWING ARRAY CONTAINS EMISSION FACTORS IN GRAMS PER VEHICLE
C      MILE TRAVELLED (VMT) BASED ON VEHICLE CLASS AND ROAD CLASS.  THESE
C      ARE READ FROM CARDS IN THE FOLLOWING ORDER (I,J,K)
C          I = 1,4 (VEHICLE CLASS),
C          J = 1,4 (ROAD TYPE),
C          K = 1,5 (POLLUTANT)
C
C      HEAD (IREADR,100) EFHV
C      100 FORMAT (8F10.0)
C
C      C*** Iwant -- SUBROUTINE OUTPT3 OUTPUT CHOICE
C          1 -- IPP INPUT CARDS OR
C          2 -- CDM INPUT CARDS OR
C          3 -- AQDM INPUT CARDS
C
C      HEAD (IREADR,120) Iwant
C      120 FORMAT (15)
C
C      READ IN STATE AND COUNTY OF INTEREST, NUMERIC STUDY AREA, TOTAL
C      NUMBER OF GRID SQUARES, IN THE COUNTY, POLITICAL SUBDIVISION (TO
C      INCLUDE ON IPP CARDS) AND ALPHANUMERIC REGION NUMBER.
C
C      C**** SEE USERS MANUAL FOR DEFINITION OF THESE VARIABLES
C
C      140 IF (YSTATE.NE.STATE.OR.JCNTY.NE.CCNTY) GO TO 150
C
C      IF NOT FIRST COUNTY, STORE LAST-READ CAASE4 OUTPUT IN FIRST
C      LOCATION OF STORAGE.
C
C      NAREAS=NAREAS+1
C      X(1)=X(NAREAS)
C      Y(1)=Y(NAREAS)
C      AREA(1)=AREA(NAREAS)

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00011200
00011300
00011400
00011500
00011600
00011700
00011800
00011900
00012000
00012100
00012200
00012300
00012400
00012500
00012600
00012700
00012800
00012900
00013000
00013100
00013200
00013300
00013400
00013500
00013600
00013700
00013800
00013900
00014000
00014100
00014200
00014300
00014400
00014500
00014600
00014700
00014800

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DU 145 I=1,56
145 APPORT(I,1)=APPORT(I,NAREAS)
150 CONTINUE
    READ (IREADR,160) XSTATE,ICNTY,XAQCR,NAREAS,CNTY,KOUNITY,KSTATE,IPO000015200
    ILIT,IREGN
160 FORMAT (F10.0,I10,I10,F10.0,I10,6X,A4,215,9X,A1,7X,A5)
    IF (NAREAS.EQ.0) GO TO 1480
C
C*** READ IN HEADER FOR OUTPUT TABLES
C
    READ (IREADR,180) HDR
180 FORMAT (20A4)
    IERR=0
C
C*** READ IN COUNTY TOTALS FOR EACH CATEGORY
C
    CALL READI
    IF (IERR.EQ.0) GO TO 200
C
C*** HAD A PROBLEM IN READI, GET OFF WITH DIAGNOSTIC MESSAGE
C
    GO TO 1520
200 CONTINUE
    WRITE (3,220) HDR
220 FORMAT ('1'////,20A4)
C
C    DISPLAY FUELS INPUT DATA FROM SUBROUTINE READI
C
    WRITE (3,240) (FLUITS(I),I=1,56)
240 FORMAT ('0FUEL TOTALS READ IN FOLLOW - (NOTE THAT READI ROUTINE CA00017800
    CALCULATED THE LGT TRUCKS CATEGORY (NO.28) BY APPORTIONING'' FROM LG00017900
    LGT DUTY GAS (NO. 27) AND HVT DUTY GAS TRUCKS (NO.29))'/(10F12.1))00018000
    I
    WRITE (IPRINT,1260)
    WRITE (IPRINT,220) HDR
    WRITE (IPRINT,260)
260 FORMAT ('0',17X,'COUNTY-WIDE AREA SOURCE DATA USED IN CALCULATING 00018500

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```
EMISSIONS BY SOURCE CATEGORY FOR APPORTIONING'////35X,'SULFUR CONF00018600  
ENT:'//)  
    WRITE (IPRINT,280) SC  
280 FORMAT (45X,'ANTHRACITE COAL',10X,'=',F10.1,' PERCENT'/45X,'BITUMINOUS COAL',10X,  
10X,'=',F10.1,' PERCENT'/45X,'DISTILLATE OIL',11X,'=',F10.1,' PERCENT'/45X,'RESIDUAL OIL',13X,'=  
110.1,' PERCENT'/45X,'PERCENT'////)  
    WRITE (IPRINT,300) AC  
300 FORMAT (36X,'ASH CONTENT:'//45X,'ANTHRACITE COAL',10X,'=',F10.1,' PERCENT'/45X,'BITUMINOUS COAL',10X,'=  
1PERCENT'/45X,'PERCENT'////)  
    WRITE (IPRINT,320)  
320 FORMAT (31X,'*****')  
1*****//)  
    WRITE (IPRINT,340) TONSFW,TONSMB,TONSAF,DAYSF  
340 FORMAT (36X,'FOREST WILDFIRES',13X,'=',F9.1,' TONS PER ACRE'//,36X,'MANAGED BURNING',14X,'=  
1,'MANAGED BURNING',14X,'=',F9.1,' TONS PER ACRE'//,36X,'AGRICULTURAL BURNING',7X,'=',F9.1,' TONS PER ACRE'//,36X,'FROST CONTROL',10X,'=,  
1X,'=',F9.1,' DAYS PER YEAR'////)  
    WRITE (IPRINT,320)  
    WRITE (IPRINT,360) CITYDN  
360 FORMAT (51X,'POPULATION CODE = ',A1)  
  
    READ IN WEIGHTED APPORTIONING FACTORS OUTPUT FROM CAASE4  
    ON FORMATTED TAPE.  
  
    COUNTIES SHOULD BE IN ORDER BUT ALL DO NOT NECESSARILY HAVE TO BE  
    PROCESSED DURING A GIVEN RUN.      FIND THIS COUNTY  
  
400 READ (ITAPEN,420,END=1440) STATE,JCNTY,DUNNY  
420 FORMAT (11X,F3.0,20X,15,/F2.0)  
    IF (STATE.NE.XSTATE.OR.ICNTY.NE.JCNTY) GO TO 400  
  
    FOUND COUNTY WAITED  
  
    READ IN DATA FOR ALL GRID SQUARES THIS COUNTY  
    DU 480 I=2,NDINPI  
    READ (ITAPEN,440, END=4460) ID(I),STATE,JCNTY,X(I),Y(I),AREA(I),(AP00022400
```

```

IPURT(J,I),J=1,56)
440 FURNAT (15,6X,F3.0,20X,15,23X,2F10.0,10X,F10.2,24E13.5,/,32E13.5)
IF (STATE.EQ.XSTATE.AND.JCNTY.EQ.ICNTY) GO TO 480
C
C
C
ENCOUNTERED NEXT COUNTY
C
C
C
BACKSPACE ITAPEN
BACKSPACE ITAPEN
C
C
C
TOTAL GRID SQUARES
C
C
C
460 NAREAS=I-1
GO TO 520
480 CONTINUE
C
C
C
IF FELL THROUGH LOOP THEN DIMENSIONS WERE NOT ADEQUATE
C
C
C
WRITE (IPRINT,500) NDIM,STATE,JCNTY
500 FURNAT ('INDIM WAS SET TO',15,5X,'BUT MORE GRID SQUARES FOR STATE
1AND COUNTY=',F10.0,110,5X,'WERE ENCOUNTERED',/,'OINCREASE INDIM AND
1ESUBMIT JOB')
ENDFILE ITAPEN
GO TO 1520
520 CONTINUE
C
C
C
SAVE YSTATE AND ICNTY FOR NEXT COUNTY.
C
C
C
STATE=YSTATE
JCNTY=HCNTY
C
C
C
DEVELOP THE APPORTIONING FACTOR SUMS FOR EACH EMISSION CATEGORY
THESE SUMS ARE USED AS THE DENOMINATORS FOR RATIOS TO APPORTION
FUELS AND EMISSIONS INTO EACH GRID SQUARE/SOURCE CATEGORY COMB.
C
C
C
DO 560 J=1,56
AP10(J)=0.
DO 540 I=1,NAREAS

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```

      APTOT(J)=APTOT(J)+APPORT(J,I)
540 CONTINUE
560 CONTINUE
C
C
C
C
      APPORTION THE FUELS AND OUTPUT TO TABLES
      CALCULATE RATIO OF TOTAL FOR COUNTY IN EACH GRID SQUARE
      DO 600 J=1,56
      DO 600 I=1,NAREAS
      IF (APTOT(J).EQ.0.) GO TO 580
      APFUEL(J,I)=APTOT(J,I)/APTOT(J)*FLUITS(J)
      GO TO 600
580 APFUEL(J,I)=0.
600 CONTINUE
C
C
C
      OUTPUT ROUTINE FORMATS OUTPUT
      CALL OUTPUT1(APFUEL,ID,X,Y,AREA,NDIM)
      620 FORMAT ('1')
      640 FORMAT (10F10.2)
      660 FORMAT ('0')
C
C
C
      NOW COMPUTE TOTAL EMISSIONS FOR THE COUNTY FOR EACH POLLUTANT, FOR
      EACH CATEGORY, WILL APPORTION LATER (STORE IN POLLUT ARRAY)
      00026200
      00026300
      00026400
      00026500
      00026600
      00026700
      00026800
      00026900
      00027000
      00027100
      00027200
      00027300
      00027400
      00027500
      00027600
      00027700
      00027800
      00027900
      00028000
      00028100
      00028200
      00028300
      00028400
      00028500
      00028600
      00028700
      00028800
      00028900
      00029000
      00029100
      00029200
      00029300
      00029400
      00029500
      00029600
      00029700
      00029800
C*** RESIDENTIAL FUEL
      DO 680 K=1,5
      DO 680 J=1,6
      POLLUT(J,K)=EMFAC(J,K)*FLUITS(J)
680 CONTINUE
C
C
C
      HAD ADDITIONAL COEFFICIENTS FOR SOME COMBINATIONS (SULPHUR CONTENT)
      FOR CALCULATION OF SO2
      00029400
      00029500
      00029600
      00029700
      00029800
      RESIDENTIAL FUEL

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C      DO 700 J=1,4
      PULTOT(J,2)=PULTOT(J,2)*SC(J)
      700 CONTINUE
C
C*** COMMERCIAL AND INSTITUTIONAL FUEL
C
      DO 720 K=1,5
      DO 720 J=7,12
      PULTOT(J,K)=EMFACT(J,K)*FLTOTS(J)
      720 CONTINUE
C
C*** TAKE CARE OF ASH CONTENT AND SULFUR CONTENT CASES
C
C      ASH FOR COMMERCIAL AND INSTITUTIONAL (C&I) COAL
C
C      SULFUR FOR C&I FUELS
C
      DO 740 J=7,8
      K=J-6
      PULTOT(J,1)=PULTOT(J,1)*AC(K)
      PULTOT(J,2)=PULTOT(J,2)*SC(K)
      740 CONTINUE
      DO 760 J=9,10
      K=J-6
      PULTOT(J,2)=PULTOT(J,2)*SC(K)
      760 CONTINUE
C
C*** INDUSTRIAL FUEL
C
      INCLUDE ASH & SULFUR WHERE REQUIRED
C
      DO 780 J=13,14
      L=J-12
      PULTOT(J,1)=EMFACT(J,1)*FLTOTS(J)*AC(L)
      PULTOT(J,2)=EMFACT(J,2)*FLTOTS(J)*SC(L)
      DO 780 K=3,5

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00029900
00030000
00030100
00030200
00030300
00030400
00030500
00030600
00030700
00030800
00030900
00031000
00031100
00031200
00031300
00031400
00031500
00031600
00031700
00031800
00031900
00032000
00032100
00032200
00032300
00032400
00032500
00032600
00032700
00032800
00032900
00033000
00033100
00033200
00033300
00033400
00033500

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```

      PULTOT(J,K)=EMFACT(J,K)*FLTOTS(J)
      780 CONTINUE
      C
      C*** FACTOR FOR CUKE
      C
      PULTOT(15,1)=EMFACT(15,1)*FLTOTS(15)*AC(2)
      PULTOT(15,2)=EMFACT(15,2)*FLTOTS(15)*SC(2)
      DO 800 K=3,5
      PULTOT(15,K)=EMFACT(15,K)*FLTOTS(15)
      800 CONTINUE
      DO 820 J=16,20
      DO 820 K=1,5
      PULTOT(J,K)=EMFACT(J,K)*FLTOTS(J)
      820 CONTINUE
      C
      C*** NEED TO ACCOUNT FOR SULFUR CONTENT
      PULTOT(16,2)=PULTOT(16,2)*SC(3)
      PULTOT(17,2)=PULTOT(17,2)*SC(4)
      C
      C*** ON-SITE INCINERATION AND OPEN BURNING
      C
      DO 840 J=21,26
      DO 840 K=1,5
      PULTOT(J,K)=EMFACT(J,K)*FLTOTS(J)
      840 CONTINUE
      C*** THE FOLLOWING HAVE ZERO (OR UNDEFINED) EMISSION FACTORS
      C
      C
      C THE FOLLOWING CATEGORIES ARE HANDLED IN A SEPARATE ALGORITHM
      C COMBUSTING FUEL SALES, MILLS PER GALLON, TYPE VEHICLE, AND ROAD CLASS.
      C SET VALUE TO ZERO HERE
      DO 900 K=1,5
      DO 860 J=27,29
      PULTOT(J,K)=0.
      860 CONTINUE
      PULTOT(31,K)=0.
      DO 880 J=43,46
      PULTOT(J,K)=0.

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00033000
00033700
00033800
00033900
00034000
00034100
00034200
00034300
00034400
00034500
00034600
00034700
00034800
00034900
00035000
00035100
00035200
00035300
00035400
00035500
00035600
00035700
00035800
00035900
00036000
00036100
00036200
00036300
00036400
00036500
00036600
00036700
00036800
00036900
00037000
00037100
00037200

```

880	CONTINUE	00037300
900	CONTINUE	00037400
	DU 960 K=1,5	00037500
	OFF HIGHWAY GAS	00037600
	PULTOT(30,K)=EMFAC(30,K)*FLTOTS(30)	00037700
	DIESEL OFF HIGHWAY (32), DIESEL RAIL(33)	00037800
	DIESEL OFF-HIGHWAY (32), DIESEL RAIL (33), AIRCRAFT (34,35,36),	00037900
	VELL	00038000
	VESSELS (37,38,39,40), EVAPORATION (41,42)	00038100
	DU 920 J=32,42	00038200
	PULTOT(J,K)=EMFAC(J,K)*FLTOTS(J)	00038300
920	CONTINUE	00038400
	FUGITIVE DUST CATEGORIES	00038500
	DU 940 J=47,51	00038600
	PULTOT(J,K)=FLTOTS(J)*EMFAC(J,K)	00038700
940	CONTINUE	00038800
	***** FOREST WILDFIRES	00038900
	REQUIRES TONS/ACRE CALCULATION	00039000
	PULTOT(52,K)=FLTOTS(52)*TONSF*EMFAC(52,K)	00039100
	***** MANAGED BURNING	00039200
	PULTOT(53,K)=FLTOTS(53)*TONSH*EMFAC(53,K)	00039300
	***** AGRICULTURAL FIELD BURNING	00039400
	PULTOT(54,K)=FLTOTS(54)*TONSAF*EMFAC(54,K)	00039500
		00039600
		00039700
		00039800
		00039900
		00040000
		00040100
		00040200
		00040300
		00040400
		00040500
		00040600
		00040700
		00040800
		00040900

```

C*** FRUIT CONTROL
C
PULIUT(55,K)=FLTOTS(55)*DAYSF*EMFAC(55,K)
C
C*** STRUCTURED FIRES
C
PULIUT(56,K)=FLTOTS(56)*EMFAC(56,K)
C
960 CONTINUE
C
C*** NOW DEAL WITH HIGHWAY MOTOR VEHICLE SOURCES
C
THESE CALCULATIONS FOLLOW THE EPA/NADB METHOD, I.E., FUEL SALES
C AND VEHICLE CLASS MPG ARE USED TO DEVELOP TOTAL VEHICLE MILES
C TRAVELLED BY VEHICLE CLASS. THE MEASURED VEHICLE MILES REPORTED ON
C THE NEDS AREA SOURCE FORM IS ONLY USED TO DETERMINE RATIOS BY ROAD
C CLASS FOR THE VMT CALCULATED USING SALES & MPG.
C
CONSTANT USED IN CALCULATIONS
10000/(453.6*2000) WHERE 10000 CONVERTS INPUT DATA TO MILES
453.6 CONVERTS GRAMS TO POUNDS
2000 CONVERTS POUNDS TO TONS
C
CONVEH = .011023 WAS SET AT START
C*** OBTAIN RATIO FOR EACH VEHICLE CLASS.
C*** LGT VEH GAS -- 13.5 MPG
C
FUELS REPORTED IN THOUSANDS OF GALLONS
C
VLGIG=FLTOTS(27)*1.5504
C
C*** LGT TRUCK GAS -- 11.8 MPG
C
ILGIG=FLTOTS(28)*1.1804
C
C*** Hvy VEH GAS -- 7.3 MPG
C
VHVIG=FLTOTS(29)*7.303
C

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00041000
00041100
00041200
00041300
00041400
00041500
00041600
00041700
00041800
00041900
00042000
00042100
00042200
00042300
00042400
00042500
00042600
00042700
00042800
00042900
00043000
00043100
00043200
00043300
00043400
00043500
00043600
00043700
00043800
00043900
00044000
00044100
00044200
00044300
00044400
00044500
00044600

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C*** HVY VEH DIESEL -- 5.2 MPG
C
VHVD=FLTOTS(31)*5.2D5
C*** NEED RATIO OF EACH RLD = LGT DUTY GAS, RLD1 = LGT DUTY TRUCKS,
C RHDG = HVY DUTY GAS, RHDD = HVY DUTY DIESEL
C
SUMM=VLGTG+TLGTG+VHVG+VHVD
RLD=VLGTG/SUMM
RLD1=TLGTG/SUMM
RHDG=VHVG/SUMM
RHDD=VHVD/SUMM
C
C*** IF MEASURED VEHICLE MILES ARE AVAILABLE USE THEM...IF NOT USE
C DENSITY CODE TO ESTIMATE.
C
C*** TOTAL MILES = SUM OF MEASURED VEHICLE MILES
C
TOTMI=0.
DO 980 I=43,46
TOTMI=TOTMI+FLTOTS(I)
980 CONTINUE
C
IF TOTAL IS ZERO THEN USE ALTERNATE METHOD.
C
IF (TOTMI.EQ.0.) GO TO 1020
C
C*** CALCULATE EMISSIONS FOR EACH POLLUTANT, EACH MEASURED VEH MILES (L000047200
C POLLUTANT LOOP
C
DO 1000 K=1,5
DO 1000 J=1,4
C
C SUBSCRIPTS FOR MEASURED VEHICLE MILES ARE 43,44,45,46
C EMISSION FACTORS ARE IN THE ARRAY EPHV WHERE SUBSCRIPTS ARE --
C VEHICLE CLASS, ROAD TYPE, POLLUTANT
C
JJ=J+42
POLLTOT(JJ,K)=CULVEH*FLTOTS(JJ)*(RLD*EPHV(1,J,K)+RLD1*EPHV(2,J,K))+R000047300

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1000 CONTINUE
      GO TO 1140
1020 CONTINUE
      C  ALTERNATE METHOD -- MEASURED VEHICLE MILES ARE MISSING
      C  ESTIMATE WILL BE FOR RURAL AND URBAN ONLY BASED ON COUNTY DENSITY
      C  (URBANIZATION ) CODE.  IT YOU MAY BE MISSING, IF SO USE WORST CASE
      C  THAT CAN BE REPORTED, I.E., 9 INDICATING 90 PERCENT URBANIZATION.
      C
      C
      C  BECAUSE OF AMBIGUITY OF BLANK AND ZERO READ WITH NUMERIC FORMAT IN
      C  FORTRAN, CTYDEN WAS READ AS ALPHANUMERIC -- DETERMINE BLANK, ZERO
      C  THROUGH NINE.
      C
      C  DO 1060 ITOE=1,11
      C  IF (CTYDEN.NE.ITOE) GO TO 1060
      C  IF (ITOE.NE.1) GO TO 1060
      C  CTYDEN=9.
      C  WRITE (IPRINT,1040)
      C  FORMAT ('1 MISSING COUNTY DENSITY CODE, USED 9')
1040 CONTINUE
      GO TO 1100
1060 CTYDEN=ITOE-2
      GO TO 1100
1080 CONTINUE
1100 CONTINUE
      C
      C  PU IS FRACTION URBAN, PR IS FRACTION RURAL
      C
      C  PU=CTYDEN/1.001
      C  PR=1.0-PU
      C
      C  453.0 * 2000 = 907200  CONVERTS GRABS TO TONS
      C  USE MILES FROM MPG CALCULATIONS
      C
      C  TOTMI=VLGIG+ILGIG+VHVYG+VHVVD
      C  DO 1120 K=1,5

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00048400
00048500
00048600
00048700
00048800
00048900
00049000
00049100
00049200
00049300
00049400
00049500
00049600
00049700
00049800
00049900
00050000
00050100
00050200
00050300
00050400
00050500
00050600
00050700
00050800
00050900
00051000
00051100
00051200
00051300
00051400
00051500
00051600
00051700
00051800
00051900
00052000

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```

POLLUT(43,K)=0.
POLLUT(45,K)=0.
POLLUT(44,K)=TOTMI*PR*(EFHV(1,2,K)*RLD+EFHV(2,2,K)*RLD+EFHV(3,2,K)*RLD+EFHV(4,2,K)*RHDD)/9.072D5
1)*RHDD+EFHV(4,2,K)*RHDD)/9.072D5
POLLUT(46,5)=TOTMI*PU*(EFHV(1,4,K)*RLD+EFHV(2,4,K)*RLD+EFHV(3,4,K)*RLD+EFHV(4,4,K)*RHDD)/9.072D5
1)*RHDD+EFHV(4,4,K)*RHDD)/9.072D5
1120 CONTINUE
1140 CONTINUE
C
C*** OUTPUT THE COUNTY EMISSION TOTALS FOR EACH SOURCE CATEGORY AND
C POLLUTANT
C
DO 1180 K=1,5
SUMKK(K)=0.0
DO 1160 J=1,56
SUMKK(K)=SUMKK(K)+POLLUT(J,K)
1160 CONTINUE
1180 CONTINUE
WRITE (IPRINT,620)
WRITE (IPRINT,180) HDR
DO 1240 K=1,5
WRITE (IPRINT,1200) POLHGG(K),SUMKK(K)
1200 FORMAT ('TOTALS BY SOURCE CATEGORY FOR POLLUTANT ',A4,' (TONS/YR)00054200
1',/10F10.3))
WRITE (IPRINT,1220) POLHGG(K),SUMKK(K)
1220 FORMAT ('FOR POLLUTANT ',A4,' TOTAL EMISSIONS=',F15.3)
1240 CONTINUE
WRITE (IPRINT,1260)
1260 FORMAT (///'FOOTNOTE: CATEGORIES BY ROW IN SAME ORDER AS AREA SOURCE EMISSIONS TABLES')
C
C*** NOW APPORTION THE EMISSIONS TO EACH GRID SQUARE IN THE COUNTY
C ACCORDING TO APPORTIONING FACTORS CALCULATED BY CAASE4
C
C
C 5 POLLUTANTS BY 56 CATEGORIES X NUMBER OF GRID SQUARES THIS EQUALS 2800
C

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00055800
00055900
00056000
00056100
00056200
00056300
00056400
00056500
00056600
00056700
00056800
00056900
00057000
00057100
00057200
00057300
00057400
00057500
00057600
00057700
00057800
00057900
00058000
00058100
00058200
00058300
00058400
00058500
00058600
00058700
00058800
00058900
00059000
00059100
00059200
00059300
00059400

DU 1380 K=1,5
DU 1300 J=1,56
PTOTAL=POLTOT(J,K)
DU 1300 I=1,NAREAS
IF (APTOT(J).EQ.0.) GO TO 1280
C
C FRACTION BY CATEGORY AND POLLUTANT PER GRID SQUARE CALCULATION
C
APFUEL(J,I)=PTOTAL*APPORT(J,I)/APTOT(J)
GO TO 1300
1280 APFUEL(J,I)=0.
1300 CONTINUE
C
C**** NEED TO SAVE FOR IPP, OR CDM, OR ADDM
C
DU 1340 I=1,NAREAS
C
C SUM ALL CATEGORIES FOR EACH GRID SQUARE FOR EACH POLLUTANT FOR
C DISPERSION MODEL AREA SOURCE FORMAT
C
SUM=0.
DU 1320 J=1,56
SUM=SUM+APFUEL(J,I)
1320 CONTINUE
DU 1340 I=1,NAREAS
OUTIPP(I,K)=SUM
1340 CONTINUE
CONTINUE
C
C NOW OUTPUT APPORTIONED EMISSIONS, LABEL ACCORDING TO POLLUTANT
C
C KODI14L OUTP12 FORMATS AND PRINTS TABLES OF EMISSIONS BY SOURCE
C CATEGORY AND GRID SQUARE. CALLED ONCE FOR EACH POLLUTANT
C
CALL OUTP12(K,APFUEL,ID,X,Y,AREA,NDI4)
1380 CONTINUE
C
C**** NOW OUTPUT IPP, OR CDM, OR ADDM CARD IMAGES

```

C				00059500
C				00059600
C	ROUTINE OUTPT3 FORMATS, PRINTS, AND PUNCHES DISPERSION MODEL.			00059700
C	AREA SOURCE INPUT DATA.			00059800
C				00059900
C	CALL OUTPT3(OUTPTP,ID,X,Y,AREA,NDIM,IWANT)			00060000
C				00060100
C***	DO WE HAVE ANOTHER COUNTY			00060200
C				00060300
				00060400
	GO TO 140			00060500
1440	CONTINUE			00060600
	WRITE (IPRINT,1460) XSTATE,ICNTY			00060700
1460	FORMAT ('*JUST HIT END OF FILE ON CAASE4 OUTPUT TAPE WHILE TRYING			00060800
	1TU PROCESS FIPS STATE AND COUNTY NUMBER',F10.0,I10)			00060900
	GO TO 1520			00061000
1480	WRITE (IPRINT,1500)			00061100
1500	FORMAT ('*NO MORE COUNTIES')			00061200
1520	CONTINUE			00061300
	REWIND ITAPEN			00061400
	ENDFILE ITAPEU			00061500
	REWIND ITAPEU			00061600
	RETURN			00061700
	END			

```

SUBROUTINE READ1
C
C***** ROUTINE READS FUEL TOTALS FROM JOB INPUT STREAM CARDS IN NEDS
C      AREA SOURCE FORMAT FOR COUNTY, STATE, STUDY AREA (AQCR, AQMA, ETC)
C      OF INTEREST.
C
C*****CARDS A1 THROUGH A5 ONLY ARE TO BE INPUT
C      RETURNS IERR =0 FOR SUCCESSFUL READ
C      IERR=1 FOR PROBLEMS.
C
COMMON/WHICH/XSTATE, ICNTY, XAQCR, CNTY, NAREAS, HDR(20), IPOLIT, IREGN
COMMON /FUELS/KSTATE, KOUNTY, AQCR, YR, SC(4), AC(2), FLTOTS(56), CTYDEN,
1TUNSF, TONSMB, TONSAF, DAYSF
COMMON/LOUNIT/IREADR, ITAPE1, ITAPEN, ITAPEO, IPUNCH, IPRINT, IERR
DIMENSION ICARD(5)
IERR=0
C
C***** FUELS TOTALS TO BE READ IN FROM CARDS *****
C
READ (IREADR, 5020) LSTATE, LCNTY, AQCR, YR, SC, AC, (FLTOTS(I), I=1,6),
1ICARD(1), (FLTOTS(I), I=7,20), ICARD(2), (FLTOTS(I), I=21,27),
2(FLTOTS(I), I=29,33), CTYDEN, ICARD(3), (FLTOTS(I), I=34,46), ICARD(4),
3(FLTOTS(I), I=47,52), TUNSF, FLTOTS(53), TONSMB, FLTOTS(54), TONSAF,
4FLTOTS(55), DAYSF, FLTOTS(56), ICARD(5)
5020 FORMAT (I2, I4, F3.0, F2.0, 23X, 4F2.1, 2F3.1, F5.0, F6.0, F5.0, F4.0, F5.0,
1F4.0, 2X, I1/ 9X, 4F5.0, F4.0, F4.0, F2.0, 2F6.0, F4.0, 3F5.0, F3.0, F4.0, 6X, I1/
29X, F6.0, F5.0, F4.0, 2F6.0, F5.0, F7.0, 3F6.0, 2F5.0, A1, 2X, I1/
39X, F4.0, F6.0, F5.0, 2F4.0, F5.0, F4.0, F6.0, F5.0, 3F6.0, F7.0, 2X, I1/
49X, F7.0, F5.0, F6.0, 2F5.0, F7.0, F3.0, F6.0, F3.0, F6.0, F3.0, F4.0, F3.0,
5F5.0, 2X, I1)
DO 100 I=1,5
100 IF(ICARD(I).NE.1) GO TO 200
C
CHECK TO SEE IF COUNTY IS IN SAME ORDER AS CALLING ROUTINE REQUEST
C
IF(LSTATE.EQ.KSTATE.AND.KOUNTY.EQ.LCNTY.AND.AQCR.EQ.XAQCR) GO
1 TO 7000
C
00000100
00000200
00000300
00000400
00000500
00000600
00000700
00000800
00000900
00001000
00001100
00001200
00001300
00001400
00001500
00001600
00001700
00001800
00001900
00002000
00002100
00002200
00002300
00002400
00002500
00002600
00002700
00002800
00002900
00003000
00003100
00003200
00003300
00003400
00003500
00003600
00003700

```

000003800
000003900
000004000
000004100
000004200
000004300
000004400
000004500
000004600
000004700
000004800
000004900
000005000
000005100
000005200
000005300
000005400
000005500
000005600
000005700
000005800
000005900
000006000


```

C      SUBROUTINE OUTPT1 (APFUEL,ID,X,Y,AREA,NDIM)
C
C      CAASES OUTPUT SUBROUTINE OUTPT1- OUTPUTS APPORTIONED FUEL TOTALS
C      FROM APPORTIONING OF COUNTY TOTALS TO SUB-COUNTY GRID SQUARES
C
C      C*** PLACE 45 GRID SQUARES ON EACH PAGE FOR EACH OF THE 5 TABLES
C      THE FIVE TABLES ARE REQUIRED TO ACCOMMODATE THE COLUMNS NECESSARY
C      FOR ALL SOURCE CATEGORIES ASSOCIATED WITH EACH GRID SQUARE
C
C      COMMON/WHICH/XSTATE,ICNTY,XAQCR,CNTY,NAREAS,      HDR(20)
C      1,IPULIT,IREFN
C      COMMON /FUELS/KSTATE,KOUNTY,AQCH,YR,SC(4),AC(2),FLTUTS(56),CTYDEN,
C      1TUNSPW,TONSMB,TONSAF,DAYSF
C      COMMON/OUNT/IREADR,ITAPET,ITAPEN,ITAPEO,IPUNCH,IPRINT,IERR
C      DIMENSION APFUEL(56,NDIM)
C      DIMENSION X(NDIM),Y(NDIM),AREA(NDIM),ID(NDIM)
C      IPAGE = 0
C      ITABLE=1
C
C      IPUT IS FLAG FOR HEADER RECORD UN OUTPUT TO INCIDACT THAT
C      APPORTIONED FUELS FOLLOW.
C
C      IPUT = 1
C      IEND=0
C
C      ISTART TO IEND BRINGS THE ARRAY OUT IN SETS OF 45 GRID SQUARES
C      EACH
C
C      50 ISTART=IEND+1
C      IEND=ISTART+44
C
C      MAY NOT BE 45 REMAINING--CHECK IT
C
C      IEND= MINO(IEND,NAREAS)
C      IPAGE=IPAGE+1
C      75 WRITE(IPRINT,5000) HDR,ITABLE,IPAGE
C      5000 FORMAT('1',20A4,2X,'APPORTIONED FUELS, TABLE ',12,' ', PAGE ',

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```

325 CONTINUE
GO TO 600
400 CONTINUE
C
C***** OUTPUT GRID SQUARE NUMBERS AND SOURCE CATEGORIES 34 THROUGH 46
C
WRITE (IPRINT,5400)
DO 425 I=ISTART,IEND
WRITE (IPRINT,5410) ID(I), CNTY, (APFUEL(J,I),J=34,46)
425 CONTINUE
GO TO 600
500 CONTINUE
C
C***** OUTPUT GRID SQUARE NUMBERS AND SOURCE CATEGORIES 47 THROUGH 56
C
WRITE (IPRINT,5500)
DO 525 I=ISTART,IEND
WRITE (IPRINT,5510) ID(I), CNTY, (APFUEL(J,I),J=47,52),TONSFW,
1APFUEL(53,I),TONSMR, APFUEL(54,I), TONSAF, APFUEL(55,I), DAYSF,
2APFUEL(56,I)
525 CONTINUE
600 CONTINUE
C
C***** UPDATE TABLE NUMBER OF THIS SET (45 OR LESS) OF GRID SQUARES
C
ITABLE=ITABLE+1
IF (ITABLE.LE.5) GO TO 75
C
C***** UPDATE WHICH SET OF GRID SQUARES TO OUTPUT, QUIT IF DONE
C
ITABLE=1
IF (NAREAS.EG.IEND) GO TO 700
GO TO 50
700 CONTINUE
C
C***** OUTPUT FORMATTED TAPE, WHERE:
C ALL ALPHANUMERICS ARE A4

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```

00007500
00007600
00007700
00007800
00007900
00008000
00008100
00008200
00008300
00008400
00008500
00008600
00008700
00008800
00008900
00009000
00009100
00009200
00009300
00009400
00009500
00009600
00009700
00009800
00009900
00010000
00010100
00010200
00010300
00010400
00010500
00010600
00010700
00010800
00010900
00011000
00011100

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```

C ALL INTEGERS ARE I10
C ALL REAL*4 ARE E13.5
C
C FORMATTED TAPE CONTAINS ONLY DATA, I.E., IT IS NOT A 'PRINT' TAPE
C
C WRITE HEADER RECORD ON OUTPUT:
C NAREAS INDICATES HOW MANY RECORDS FOLLOW
C INPUT INDICATES TYPE OF DATA, I.E., APPORTIONED
C FUELS = 1, APPORTIONED EMISSIONS = 2
C
C WRITE(ITAPEU,5050) IREGN,KSTATE,KOUNTY,NAREAS,IPUT,TONSFW,TONSMB,
C 1 TONSAF,DAYSF
C 5050 FORMAT(1X,A4,I13,3I10,4E13.5)
C DU 750 I=1,NAREAS
C
C WRITE RECORD ON OUTPUT TAPE FOR EACH GRID SQUARE
C
C WRITE(ITAPEU,5060) IO(I),X(I),Y(I),AREA(I),(APFUEL(J,I),J=1,56)
C 5060 FORMAT(10,29E13.5,/,30E13.5)
C 750 CONTINUE
C 800 RETURN
C 5100 FORMAT('0',68X,'***** RESIDENTIAL FUEL *****')
C 1**/12X,'SOURCE',10X,'POLIT',12X,'COORDINATES',13X,'ANTH. BITUM.00013400
C 2 DIST.OIL RES.OIL NAT.GAS WOOD'/12X,'NUMBER REGION JURIS00013500
C 3 COUNTY X(KM) Y(KM) (SQ.KM) 10E11 10E11 10E4GALS 10E00013600
C 44GALS 10E7FT3 10E21'//)
C 5200 FORMAT('0',17X,'***** COMMERCIAL AND INSTITUTIONAL FUEL *****')
C 1***** INDUSTRIAL FUEL *****/200013900
C 2X,'SOURCE',10X,'ANTH. BITUM. DIST.OIL RES.OIL NAT.GAS WOOD 00014000
C 3ANTH. BITUM. COKE DIST.OIL RES.OIL NAT.GAS WOOD PROC.GAS'/00014100
C 42X,'NUMBER COUNTY 10E11 10E11 10E4GALS 10E4GALS 10E7FT3 10E00014200
C 521 10E11 10E11 10E11 10E4GALS 10E7FT3 10E21 10E7F00014300
C 613'//)
C 5300 FORMAT('0',
C 1 16X,'* ON SITE INCINERATION * ***** OPEN BURNING *****')
C 1***** GASOLINE FUEL ***** DIESEL FUEL *****/2X00014700
C 2,'SOURCE',10X,'RESID. INDUST. C-INST. RESID. INDUST. C-INST. 00014800

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3 LT,VEH. LT,TRUK HV,VEH. OFF HWY HV,VEH. OFF HWY R,LOCO, 00014900
 4/,2X,"NUMBER COUNTY 10E1T 10E1T 10E1T 10E1T 100015000
 50E1T 10E3GAL 10E3GAL 10E3GAL 10E3GAL 1000015100
 6E3GAL,///
 5310 FURMAT(16,4X,A4,F9,1,2F8,1,F10,1,F8,1,5F9,1,F11,1,F10,1) 00015300
 5400 FURMAT(0,17X,"***** AIRCRAFT ***** VESSELS ***** 00015400
 1*** *** EVAPORATION *** ***** MEASURED VEHICLE MILES *****/200015500
 2X,"SOURCE",10X,"MILIT. CIVIL COMM,L, BITUM. DE. OIL RES,OIL 00015600
 3GAS SUL,PUR. GAS,MKTD. LTO,ACC. HUR,RDS. SUB,RDS. URB,RDS. 00015700
 4/2X,"NUMBER COUNTY LC10E2 LC10E1 LC10E1 10E1T 10E4GAL 10E4GA00015800
 5L 10E3GAL TONS/YR 10E5GALS 10E4MI 10E4MI 10E400015900
 6MI,///
 5410 FURMAT(16,4X,A4,4F8,1,F7,1,F10,1,F7,1,F9,1,5F10,1) 00016100
 5500 FURMAT(0,25X,"DIRT",12X,"MISC.",48X,"AGRICULTURAL FROST CONTR000016200
 1L"/16X,"DIRT RDS AIR CONSTR. WIND LAND FOREST WILD FIR00016300
 2ES MANAGED BURNING FIELD BURNING ORCH. DAYS STRUC.// SOU000016400
 3KLE",8X,"TRAVELED STRIPS ACRES EROSION TILLING ACR HURN QUA00016500
 4NT. ACR BURN QUANT ACR HURN QUANT HURN. FIRED FIRES"/ NUM00016600
 5BLR COUNTY 10E3MI LTO CYC 10E3ACR",30X,"T/ACR",13X,"T/ACR",10X, 00016700
 6"/ACR",11X,"DY/YR #/YR,///
 5510 FURMAT(16,4X,A4,F8,1,3F8,1,F10,1,F8,1,2F10,1,2F8,1,F7,1,F8,1,F7,1,00016900
 1F9,1)
 END


```

C C LAASE5 OUTPUT SUBROUTINE OUTPT2 OUTPUTS APPORTIONED EMISSIONS
C C FROM APPORTIONING OF COUNTY TOTALS TO SUB-COUNTY GRID SQUARES.
C C K IN THE CALL LIST DETERMINES WHICH OF THE FIVE POLLUTANTS IS TO BE
C C OUTPUT
C C C*** PLACE 45 GRID SQUARES ON EACH PAGE FOR EACH OF THE 5 TABLES
C C THE FIVE TABLES ARE REQUIRED TO ACCOMMODATE THE COLUMNS NECESSARY
C C FOR ALL SOURCE CATEGORIES ASSOCIATED WITH EACH GRID SQUARE
C C
C C SUBROUTINE OUTPT2 (K,APFUEL,ID,X,Y,AREA,NDIM)
C C COMMON/WHICH/XSTATE,ICNTY,XAQCR,CNTY,NAAREAS, HDR(20)
C C 1,IPULIT,IREGN
C C COMMON /FUELS/KSTATE,KOUNTY,AQCR,YR,SC(4),AC(2),FLTOTS(56),CTYDEN,
C C 1TUNSFN,TONSMB,TONSAF,DAYSF
C C COMMON/ICOUNT/IREADR,ITAPET,ITAPEN,ITAPEU,IPUNCH,IPRINT,IERR
C C DIMENSION APFUEL(56,NDIM)
C C DIMENSION X(NDIM),Y(NDIM),AREA(NDIM),ID(NDIM)
C C DIMENSION POLL(25)
C C
C C POLL ARRAY CONTAINS LABELS FOR THE FIVE POLLUTANTS.
C C
C C DATA POLL/ (',PART',ICUL,'ATE)',, (S',ULPH',UR D',
C C 1'LOXI',DE) , (OXI',DES',OF N',ITRU',GEN)',, (',HYDR',UC
C C 2AR',BUNS',) (C',ARBO',N MU',NOXI',DE) /
C C IPAGE = 0
C C
C C INPUT USED IN OUTPUT TAPE HEADER RECORD TO INDICATE TYPE OF
C C DATA FOLLOWING.
C C
C C IPUT=2
C C AA=K
C C
C C DUMMY VARIABLE TO FILL RECORD LENGTH ON OUTPUT TAPE HEADER RECORD
C C
C C DUNE=0.
C C ITABLE = 1

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1***** RESIDENTIAL FUEL *****//12X, NUMBER REGION000007500
2 JUMIS COUNTY X(KM) Y(KM) (SQ.KM) ANTH. HITUM. DIST.000007600
3IL RES.OIL NAT.GAS WOOD'//) 00007700
DU 125 I=ISTART,IEND 00007800
WRITE(IPRINT,5110) ID(I),IREGN,IPOLIT,CNTY,X(I),Y(I),AREA(I) 00007900
1,(APFUEL(J,I),J=1,6) 00008000
5110 FURMAT(11X,16,4X,A3,6X,A1, 00008100
1 5X,A4,F9.1,F8.1,F9.2,F7.1,F9.1,2F10.1,F11.1,F8.1) 00008200
125 CONTINUE 00008300
GU TO 600 00008400
200 CONTINUE 00008500
C 00008600
C*** OUTPUT GRID SQUARE NUMBERS AND SOURCE CATEGORIES 7 THROUGH 20 00008700
C 00008800
WRITE(IPRINT,5200) 00008900
5200 FURMAT('0', ' SOURCE',10X,'***** COMMERCIAL AND INSTITUTIONAL FUEL *****00009000
2EL ***** ***** INDUSTRIAL FUEL *****00009100
2*****//2X, NUMBER COUNTY ANTH. HITUM. DIST.OIL RES.OIL 00009200
3NAT.GAS WOOD ANTH. BITUM. COKE DIST.OIL RES.OIL NAT.GAS 00009300
4WOOD PROC.GAS'//) 00009400
DU 225 I=ISTART,IEND 00009500
WRITE(IPRINT,5210) ID(I), CNTY, (APFUEL(J,I),J=7,20) 00009600
5210 FURMAT(16,4X,A4,F8.1,F7.1,F9.1,F10.1,F9.1,F8.1,F7.1,F7.1, 00009700
1 F7.1,F10.1,F11.1,F9.1,2F7.1) 00009800
225 CONTINUE 00009900
GU TO 600 00010000
300 CONTINUE 00010100
C 00010200
C*** OUTPUT GRID SQUARE NUMBERS AND SOURCE CATEGORIES 21 THROUGH 53 00010300
C 00010400
WRITE(IPRINT,5300) 00010500
5300 FURMAT('0', ' SOURCE',10X, 00010600
1 ***** GASOLINE FUEL ***** ON SITE INCINERATION * ***** OPEN BURNING ***** ***00010700
3, NUMBER COUNTY RESID. INDUST. C-INST. C-INST. DIESEL FUEL *****//,2X00010800
4I. LT.VEH. LI.TRUK HV.VEH. OFF HWY HV.VEH. OFF HWY R.LUCO00010900
5'//) 00011000

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DU 525 I=ISTART,IEND
WRITE(IPRINT,5310) ID(I), CNTY, (APFUEL(J,I),J=21,33)
5310 FORMAT(16,4X,A4,F9.1,2F8.1,F10.1,F8.1,5F9.1,F8.1,F11.1,F10.1)
325 CONTINUE
GO TO 600
400 CONTINUE
C
C*** OUTPUT GRID SQUARE NUMBERS AND SOURCE CATEGORIES 34 THROUGH 46
C
WRITE(IPRINT,5400)
5400 FORMAT('0', ' SOURCE',10X,'***** AIRCRAFT ***** VES*****
1SELS ***** *** EVAPORATION *** ***** MEASURED VEHICLE MIL*****
2ES *****// NUMBER COUNTY MILIT. CIVIL COMM'L. RITUM. DE,*****
A',,00012500
3UIL RES.OIL GAS SOL.PUR. GAS.MKTD. LTD.ACC. RUR.RDS. SUB.R*****
4US. URB.RDS.//)
DU 425 I=ISTART,IEND
WRITE(IPRINT,5410) ID(I), CNTY, (APFUEL(J,I),J=34,46)
5410 FORMAT(16,4X,A4,4F8.1,F7.1,F10.1,F7.1,F9.1,F10.1,F9.1,3F10.1)
425 CONTINUE
GO TO 600
500 CONTINUE
C
C*** OUTPUT GRID SQUARE NUMBERS AND SOURCE CATEGORIES 47 THROUGH 56
C
WRITE(IPRINT,5500)
5500 FORMAT('0',25X,'DIRT',12X,'MISC.',48X,'AGRICULTURAL FROST CONTRI*****
1L// SOURCE',8X,'DIRT RDS AIR CONSTR. WIND LAND FORES*****
21 WILD FIRES MANAGED BURNING FIELD HURNING ORCH. DAYS SITU*****
4L.// NUMBER COUNTY TRAVELED STRIPS ACRES EROSION TILLING AC*****
5K BURN QUANT. ACK BURN QUANT ACR BURN QUANT BURN. FIRED F*****
6LES'//)
DU 525 I=ISTART,IEND
WRITE(IPRINT,5510) ID(I), CNTY, (APFUEL(J,I),J=47,52), TONSFW,
1APFUEL(53,I), TONSMH, APFUEL(54,I), TONSAF, APFUEL(55,I), DAYSF,
2APFUEL(56,I)
5510 FORMAT(16,4X,A4,F8.1,3F8.1,F10.1,F8.1,2F10.1,2F8.1,F7.1,F8.1,F1.1,00014800

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```

1F9.1)
525 CONTINUE
600 CONTINUE
C**** UPDATE TABLE NUMBER FOR THIS SET (45 OR LESS) OF GRID SQUARES
C
C      ITABLE = ITABLE + 1
      IF(ITABLE.LE.5) GO TO 75
C**** UPDATE WHICH SET OF GRID SQUARES TO OUTPUT, QUIT IF DONE
C
      ITABLE = 1
      IF(NAREAS.EQ.IEND) GO TO 700
      GO TO 50
700 CONTINUE
C**** OUTPUT FORMATTED TAPE, WHERE:
C      ALL ALPHANUMERICS ARE A4
C      ALL INTEGERS ARE I10
C      ALL REAL*4 ARE E13.5
C
      FORMATTED TAPE CONTAINS ONLY DATA, I.E., IT IS NOT A 'PRINT' TAPE
C
      WRITE HEADER RECORD ON OUTPUT TAPE:
      NAREAS INDICATES HOW MANY RECORDS FOLLOW;
      IPUT INDICATES TYPE OF DATA, I.E., APPORTIONED
      FUELS = 1, APPORTIONED EMISSIONS = 2
C
      WRITE(ITAPE0,5050) IREFN,KSTATE,KOUNTY,NAREAS,IPUT,XK,DUM,DUM,DUM
5050 FORMAT(1X,A4,I13,5I10,4E13.5)
      DU 750 I=1,NAREAS
C
      WRITE RECORD ON OUTPUT TAPE FOR EACH GRID SQUARE
C
      WRITE(ITAPE0,5060) ID(I),X(I),Y(I), AREA(I),(APFUEL(J,I),J=1,56)
5060 FORMAT(10,29E13.5,/,30E13.5)
      750 CONTINUE

```

```

00014900
00015000
00015100
00015200
00015300
00015400
00015500
00015600
00015700
00015800
00015900
00016000
00016100
00016200
00016300
00016400
00016500
00016600
00016700
00016800
00016900
00017000
00017100
00017200
00017300
00017400
00017500
00017600
00017700
00017800
00017900
00018000
00018100
00018200
00018300
00018400
00018500

```

00018600
00018700
00018800
00018900
00019000
00019100

WRITE (TAPEU,5070)
1 (PULTOT(J,K),J=1,56)
5070 FORMAT (26E13.5,/,30E13.5)
800 CONTINUE
RETURN
END

[illegible]


```

C
C      SET STACK HEIGHT TO 33FT. (APPROXIMATELY 10 METERS)
C
      1000 ISACK = 33
      WRITE(IPRINT,5010)
5010  FORMAT('1')
      WRITE(IPRINT,5006) HDR
5006  FORMAT(20A4,5X,'IPP INPUT CARD IMAGES'////)-
      DO 100 I=1,NAREAS
C
C      SET COORDINATES AND AREA TO INTEGERS
C
      1A=A(I)*10.+5
      1V=V(I)*10.+5
      1AREA=AREA(I)*10.+5
C
C      CONVERT EMISSIONS FROM TONS/YR TO TONS/DAY
C
      SU=OUTIPP(I,2)/365.
      SP=OUTIPP(I,1)/365.
      AMU=OUTIPP(I,3)/365.
      MC =OUTIPP(I,4)/365.
      CU =OUTIPP(I,5)/365.
      1UU=10(I)
C
C**** LONGSTRUCT FORMAT FOR LEADING ZEROES (REQUIRED IN IPP DISPERSION
C      MODEL)
C**** MUST BE THREE DIGIT
C
      5 1P(100,GE,100,AND,100,LT,1000) GO TO 30
      1P(100,GE,1000) GO TO 40
      1P(100,GT,9) GO TO 10
C
C*** LESS THAN 10 (1 DIGIT)
C
      1P(4) = ZERO31
      1P(5) = ZERO32

```

```

00003800
00003900
00004000
00004100
00004200
00004300
00004400
00004500
00004600
00004700
00004800
00004900
00005000
00005100
00005200
00005300
00005400
00005500
00005600
00005700
00005800
00005900
00006000
00006100
00006200
00006300
00006400
00006500
00006600
00006700
00006800
00006900
00007000
00007100
00007200
00007300
00007400

```

00007500
00007600
00007700
00007800
00007900
00008000
00008100
00008200
00008300
00008400
00008500
00008600
00008700
00008800
00008900
00009000
00009100
00009200
00009300
00009400
00009500
00009600
00009700
00009800
00009900
00010000
00010100
00010200
00010300
00010400
00010500
00010600
00010700
00010800
00010900
00011000
00011100

```

      FM(6) = XII
      GO TO 50

C*** BETWEEN 10 AND 100 ( 2 DIGITS)

      10 CONTINUE
      FM(4) = ZERO2
      FM(5) = BLANK
      FM(6) = XII
      GO TO 50

C*** BETWEEN 100 AND 1000 ( 3 DIGITS)

      30 FM(4) = ZERO1
      FM(5) = BLANK
      FM(6) = XIII
      GO TO 50

C*** 1000 OR GREATER ( 4 DIGITS)

      40 CONTINUE
      FM(4) = BLANK
      FM(5) = BLANK
      FM(6) = XIV
      GO TO 100

      50 CONTINUE
      WRITE (IPUNCH,FM1 ) IREGN,ID(1),IX,IY,IAREA,IPOLII,ISTACK,
      150,SP,X40,MC,CO,ISTATE,KOUNTY
      WRITE (IPOLII,5005) IREGN,ID(1),IX,IY,IAREA,IPOLII,ISTACK,
      150,SP,X40,MC,CO,ISTATE,KOUNTY
      5005 FORMAT(IX,A5,'9999',I4,'0',I4,I5,I4,I4,A1,I4,5F7.3,2I5,2X,'A')
      C
      C
      C
      WRITE CARD IMAGE TO TAPE

      99 WRITE (ITAPE,FM1) IREGN,ID(1),IX,IY,IAREA,IPOLII,ISTACK,
      150,SP,X40,MC,CO,ISTATE,KOUNTY
      100 CONTINUE
      GO TO 110

```

```
C
C**** OUTPUT CDM INPUT CARD IMAGES
C
C
C
C
C    SET STACK HEIGHT TO 10 METERS
C
C      2000 STAK = 10.0
C          CONV = 10.5
C          WHILE(IPRINT,5010)
C            WRITE(IPRINT,5011) HDR
C          FORMAT(20A4,5X,'CDM INPUT CARD IMAGES'////)
C          DO 200 I=1,NAREAS
C
C            SET COORDINATES AND SIDE LENGTH TO INTEGER METERS
C
C              IXCORD = X(I) * 1000. + .5
C              IYCORD = Y(I) * 1000. + .5
C              IWLTH = SQRT(AREA(I)) * 1000. + .5
C
C            CONVERT TONS/YR TO GRAMS/SECOND
C
C              SP = OUTIPP(1,1)/365. * CONV
C              SU = OUTIPP(1,2)/365. * CONV
C              WHILE(IPUNCH,5020) IXCORD,IYCORD,IWLTH,SP,SU,STAK
C                5020 FORMAT(16,2I7,2F8.5,F7.1)
C              WRITE(IPRINT,5021) IXCORD,IYCORD,IWLTH,SP,SU,STAK
C              5021 FORMAT(1X,16,2I7,2F8.5,F7.1)
C
C            WRITE CARD IMAGE TO TAPE
C
C              WRITE(ITAPE0,5020) IXCORD,IYCORD,IWLTH,SP,SU,STAK
C              200 LU=ITape
C              GO TO 110
C
C**** OUTPUT AQDM INPUT CARD IMAGES
C
```

```

C      SET STACK HEIGHT TO 33FT (APPROXIMATELY 10 METERS)
C
5000  STACK = 33.0
      WRITE (IPRINT, 5010)
      WRITE (IPRINT, 5029) HDR
5029  FORMAT(20A4,5X,"AQDM INPUT CARD IMAGES'////)
      WRITE (IPUNCH, 55) NAREAS
55    FORMAT(' NSORCE= ',I9,'')
C
C      CONVERT TONS/YR TO TONS/DAY
C
      SP = OUTIPP(1,1)/365.
      SU = OUTIPP(1,2)/365.
C
C      FIRST CARD NEEDS 'SOURCE=' FOR NAME LIST
C
      WRITE (IPUNCH, 60) X(1), Y(1), AREA(1), SU, SP, STACK
60    FORMAT(' SOURCE= ',F9.1,'',F9.1,'',F9.2,'',F9.3,'',F9.3,'',
1F9.1,'')
      WRITE (IPRINT, 5030) X(1), Y(1), AREA(1), SU, SP, STACK
C
C      WRITE CARD IMAGE TO TAPE
C
      WRITE (ITAPEU, 5030) X(1), Y(1), AREA (1), SU, SP, STACK
C
C      OUTPUT REMAINDER OF CARD
C
      DO 500 I=2, NAREAS
      SP = OUTIPP(1,1)/365.
      SU = OUTIPP(1,2)/365.
      WRITE (IPUNCH, 5030) X(I), Y(I), AREA(I), SU, SP, STACK
5030  FORMAT(10X,F9.1,'',F9.1,'',F9.2,'',F9.3,'',F9.3,'',F9.1,'')
      WRITE (IPRINT, 5030) X(I), Y(I), AREA(I), SU, SP, STACK
C
C      WRITE CARD IMAGE TO TAPE
C
      WRITE (ITAPEU, 5030) X(I), Y(I), AREA(I), SU, SP, STACK

```

300 CONTINUE
110 CONTINUE
RETURN
END

00018600
00018700
00018800
00018900

APPENDIX F

GTGR TABLES AND FORTRAN SOURCE CODE LISTINGS

DIRECT ACCESS FILE CREATION PROGRAM

3+2604449362-412876753+100073726+4185134-05315+75661-0049-0182
4+2608640393-513026190+100225200+4196712-05865+75817-0055-0184
5+2612843155-613327265+100377008+4208997-06421+75993-0062-0187
6+2617058761-713780330+100529187+4222402-06984+76189-0068-0189
7+2621288336-814385777+100681777+4236939-07554+76404-0075-0191
8+2625533021-915144034+100834816+4252623-08131+76639-0082-0194
0000 000 000 000 0000000 000 00 000 000 0000000000000000000
2+2700186693-308627851+090912877+4325947-04897+74973-0041-0186
3+2704517724-408615743+100062951+4336302-05459+75104-0047-0189
4+2708859674-508753846+100213306+4347789-06028+75255-0053-0191
5+2713213681-609042462+100363982+4360418-06604+75424-0060-0193
6+2717580896-709481930+100515016+4374207-07186+75613-0066-0195
7+2721962485-810072627+100666446+4389167-07775+75821-0073-0198
8+2726359625-910814968+100818312+4405313-08372+76048-0079-0200
00 000 00000 000000000000000000000000 000 000 000 000 000000000000
2+2800094633-304227120+099902963+4475327-05016+74404-0039-0193
3+2804575169-404204527+100051893+4485938-05097+74529-0045-0195
4+280906090-504330996+100201093+4497719-06185+74673-0051-0197
5+2813571030-604606814+100350598+4510681-06779+74836-0057-0199
6+2818088661-705032308+100500448+4524840-07381+75017-0064-0202
7+2822621084-805607838+100650680+4540209-07989+75218-0070-0204
8+2827169486-906333808+100801333+4556802-08606+75438-0077-0207
0000000 00000000000000000000000000000000000 0000000 0000000000000000
2+2899992543-299677583+099892818+4623551-05129+73817-0037-0199
3+2904621421-399644256+100040567+4634 06-05728+73936-0043-0201
4+2909261757-499758803+100188573+4646468-06334+74073-0049-0203
5+2913914763-600021498+100336871+4659749-06948+74228-0055-0206
6+2918581665-700432654+100485498+4674263-07568+74403-0061-0208
7+2923263705-800992618+100634494+4690026-08196+74596-0068-0211
8+2927962138-901701777+100783895+4707051-08831+74808-0074-0213
0000000000000000000000000000000000000000000 0000000 000 000 000 000 0000000000000
2+2999880196-294980416+099882453+4770582-05235+73211-0034-0205
3+3004656218-394936116+100028985+4781669-05853+73324-0040-0207
4+3009443947-495038467+100175760+4793997-0647 +73454-0046-0209
5+3014244632-595287728+100322813+4807582-07109+73602-0053-0212
6+3019059535-695684198+100470181+4822438-07748+73769-0059-0214
7+3023889936-796228208+10 617902+4838579-08395+73955-0065-0217
8+3028737128-896920132+100766013+4856022-09049+74159-0071-0219
0000000 00000000000000000000000000000000000 0000000 000 000 000 000 0000000000000
2+3090757380-290136828+099871883+4916385-05335+72588-0032-0211
3+3104679311-390081331+100017161+4927689-05970+72693-0038-0213
4+3109613183-490171227+1001626 8+4940271-06613+72817-0044-0215
5+3114560283-590406757+100308440+4954146-07263+72958-0050-0218
6+3119521911-690788206+100454512+4969328-07920+73117-0056-0220
7+3124494380-791315893+10060 921+4985832-08585+73295-0062-0223
8+3129494021-891990172+10 747704+5003675-09259+73491-0 68-0226
0000000000000000 000 0000000 000000000000000000 000 000 000 000 0000000000000
2+3190623897-285148068+099861119+5060923-05428+71947-0030-0217
3+3204690464-385081165+1000 5108+5072430-06081+72045-0036-0219
4+3209769195-485158356+100149312+5085252-06742+72161-0042-0221

5+3214861410-585379873+100293760+5099402-07410+72295-0048-0224
6+3219968446-685745983+100438505+5114895-08085+72447-0054-0226
7+3225091654-786256990+100583566+5131747-08768+72617-0060-0229
8+3230232399-886913233+100728984+5149974-09460+72805-0066-0232
00000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000
2+3299479559-280015417+099850176+5204161-05514+71288-0028-0222
3+3304689456-379936910+099992841+5215858-06185+71380-0033-0225
4+3309911724-480001166+100135706+5228905-06863+71480-0039-0227
5+3315147720-580208401+100278806+5243315-07549+71615-0045-0230
6+3320398813-680558869+100422177+5259104-08242+71759-0051-0232
7+3325660392-781052856+100565853+5276287-08943+71920-0057-0235
8+3330951858-881690688+100709870+5294832-09653+72100-0063-0238
00000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000
2+3399324194-274740192+099839068+5346064-05593+70612-0025-0228
3+3404676080-374649899+099980374+5357937-06281+70696-0031-0231
4+3410040529-474701002+100121865+5371194-06977+70798-0037-0233
5+3415418933-574893703+100263577+5385849-07680+70917-0042-0236
6+3420812698-675228240+100405543+5401918-08391+71053-0048-0238
7+3426223245-775704885+100547799+5419417-09110+71206-0054-0241
8+3431652014-876323946+100690379+5438362-09837+71377-0060-0244
000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000
2+3499157644-269323745+099827809+5486598-05665+69919-0023-0234
3+3504650142-369221497+099967721+5498632-06370+69996-0028-0236
4+3510155382-469259245+100107805+5512084-07083+70090-0034-0239
5+3515674788-569437175+100248093+5526969-07803+70201-0040-0241
6+3521209803-669755510+100388620+5543302-08531+70329-0046-0244
7+3526761881-770214505+100529420+5561100-09268+70474-0051-0247
8+3532332496-870814452+100670528+5580379-10013+70637-0057-0250
000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000
2+3598979766-263767463+099816412+5625730-05730+69209-0020-0239
3+3604611465-363653106+099954898+5637910-06452+69279-0026-0242
4+3610256070-463677310+100093539+5651542-07181+69365-0032-0244
5+3615915039-563840248+100232370+5666641-07919+69468-0037-0247
6+3621589846-664142124+100371423+5683222-08664+69588-0043-0250
7+3627281982-764583180+100510733+5701302-09417+69725-0048-0253
8+3632992955-865163688+100650334+5720897-10180+69879-0054-0256
000000 0000000000000000 0000000000 0000000000 000 000 000 000
2+3698790428-258072765+099804893+5763425-05788+68483-0018-0245
3+3704559886-357946160+099941918+5775737-06526+68545-0023-0247
4+3710342397-457956649+100079084+5789534-07272+68624-0029-0250
5+3716139454-558104387+100216424+5804831-08026+68719-0034-0253
6+3721952564-658389565+100353970+5821643-08788+68830-0040-0255
7+3727783251-758812407+100491756+5839984-09558+68959-0046-0258
8+3733633056-859373169+100629816+5859882-10337+69104-0051-0261
0018000000 000 000 000 000 000 000 000 000 000 000 000 000 000
2+3798589516-252241104+099793266+5899650-05838+67740-0016-0250
3+3804495255-352102127+099928798+5912080-06593+67795-0021-0253
4+3810414181-452098742+100064456+5926026-07355+67866-0026-0255
5+3816347818-552231091+100200272+5941505-08125+67953-0032-0258
6+3822297707-652499349+100336277+5958532-08904+68056-0037-0261


```

C THIS PROGRAM WRITES UTM ZONE TO ZONE TRANSFORMATION TABLES TO
C DISK USING THE FORTRAN DIRECT ACCESS I/O METHOD. THE TABLES
C COVER UTM ZONES ON THE CLARKE 1866 SPHEROID THAT SPAN THE U.S.
C THE TABLES ARE ACCESSED WHEN THE GIGR SUBROUTINE IS CALLED TO
C TRANSFORM UTM COORDINATES FROM ONE ZONE TO AN ADJACENT ZONE.
C

```

```

      DIMENSION B1(8,8)
      REAL*8 B1
      DEFINE FILE 9(61,768,L,IJK)

```

```

C
C     TABLES ARE CARD INPUT AND WRITTEN ON DISK.
C     CARD COLUMN ONE IS SKIPPED.
C

```

```

      DO 10 JBLOCK=1,61
      READ(5,1000) ((B1(I,J),J=1,8),I=1,8)
      WRITE (9,JBLOCK) B1
10 CONTINUE
      IJK=1

```

```

C
C     TABLES ARE READ FROM DISK AND PRINTED.
C

```

```

      DO 20 JBLOCK=1,61
      READ (9,JBLOCK) B1
      WRITE (6,2000) ((B1(I,J),J=1,8),I=1,8)
20 CONTINUE
1000 FORMAT(1X,F11.5,2F10.3,F8.3,2F6.3,2F5.3)
2000 FORMAT(1X,F12.5,2F11.5,F9.3,2F7.5,2F6.3)
      STOP
      END

```